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Subterranea

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Issue 13

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**Soviet Maps
Part II**

**Communications
In Context**

**Submarine Base
Of The Future**

**Books, News
and Reviews**



**SUBTERRANEA
BRITANNICA**
www.subbrit.org.uk

Subterranea Britannica is a society devoted to the study of man-made and man-used, underground structures and the archaeology of the Cold War. The main focus of interest is on abandoned and forgotten structures and, in the case of Cold War structures, studies are entirely confined to declassified and decommissioned structures.

The society is open to all and its membership includes all walks of life. Members are invited to contribute to this newsletter even if this just means sending very welcome snippets from newspapers and magazines.

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Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles, book reviews, press cuttings, extracts from books and journals, letters to the editor etc. are welcome. However the editor reserves the right not to publish material without giving a reason. The committee of Subterranea Britannica and the editor do not necessarily agree with any views expressed and cannot check the accuracy of any material sent in.

Front and rear cover images are of the Swedish Railways bunker in Soderhamns, built to house rail mounted mobile transformer stations. -
Photos by Nick Catford



News

SUBTERRANEA BRITANNICA NEWS AND NOTICES

POSSIBLE REGISTRATION OF SUBTERRANEA BRITANNICA AS A CHARITABLE INCORPORATED ORGANISATION

The October 2005 Annual General Meeting approved the motion that the Committee be authorised to take steps to seek the incorporation of Subterranea Britannica as a company without share capital, with liability limited by guarantee; and the registration of the new company as a charity

Some work has been undertaken on re-casting the Society's constitution in the form of a Memorandum and Articles of Association, as required under the Companies and Charities Acts. Progress in this direction has been put on hold in the light of the Charities Act 2006, which makes provision for the establishment of Charitable Incorporated Organisations (CIOs), combining the advantages of limited liability and charitable status. It is envisaged by the Charity Commission that, following the enactment of secondary legislation, registration as a CIO will be possible from 2008.

It is now proposed to register the Society as a Charitable Incorporated Organisation. On the Committee establishing the proposed new legal entity, the membership in General Meeting will be recommended to wind up the unincorporated society and to transfer its assets to the Charitable Incorporated Organisation under the same name.

CIO status would offer the advantage over dual registration as at first considered of greatly simplified administration, with a requirement to complete annual returns and submit accounts, reports, etc, only to the Charities Commission.

THE SUBTERRANEA BRITANNICA 'LIBRARY': MAINLAND EUROPEAN PERIODICALS

Subterranea Britannica does not, in any meaningful sense, operate a library. However, your Society does own some printed and published items, most of which are in the care of your Chairman in Croydon.

The most important of these items are more or less complete sets of the journals of our mainland European sister societies, the most important being listed below. These are retained as they are amongst the few, perhaps the only, sets in the United Kingdom.

Publishing society / country	Acronym	Journal title	Holdings
Arbeitskreis Für Erdstallforschung [Germany]	AE	Der Erdstall	1 (1975) to date (lacking issues 4, 22, 24, and 26)
eské Speleologické Spole nosti / Czech Speleological Society [Czech Republic]	CSS	Speleo	1 (1990) to date
Club Alpino Italiano - Sezione di Napoli [Italy]	CAISN	Notiziario Sezionale	1988/1 to 1996/1 (incomplete)
Groupe de Recherches Souterraines En Milieu Artificiel [Belgium]	GRMSA	Bulletin D'information Trimestriel	1 (1991) to date
Société Francaise D'etude De Souterrains [France]	SFES	Subterranea *	1 (1972) to date
Studiegroep Onderardse Kalksteengroeven [Netherlands]	SOK	Mededelingen	1 (1982) to date (lacking issues 17, 28 and 29)
D'etude des Souterrains [Belgium]	SOBERES	Subterranea Belgica [issues 1 - 17 were titled Bulletin]	1 (1982) to date (lacking issues 2, 43, 46 - 48, and 51)

* Indexes to our French sister society's journal Subterranea have been published as follows:

KAHN, Claude, 1996, Récapitulif des sommaires de Subterranea du no. 1 (1972) au no. 99 (1996). Subterranea 100, 4 - 31 [Index]

KAHN, Claude, 2004, Récapitulif des sommaires de Subterranea du no. 1 (1972) au no. 99 (1996) Inventaire par département. Subterranea 129, 9 - 31 [Geographical index]



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Unfortunately, some issues as noted are missing from our sets, as received by the Chairman for safe-keeping a few years ago. It may be that some members have some of these missing issues on loan. If so, their return would be much appreciated.

Members wishing to consult these periodicals should contact the Chairman. They are kept alongside his own large collection of books and journals dealing with civil engineering, economic geology, industrial and mainstream archaeology, military, mining, tunnelling, water-supply, and other underground topics. As a result of his being the Hon. Librarian of the Croydon Natural History and Scientific Society Ltd, he also has access to other important materials of the same kind. That Society's Library may be visited, for reference purposes, by appointment only.

SUBTERRANEA BRITANNICA BIBLIOGRAPHICAL SERVICES: QUARRY.DOC UPDATED AND ON THE WEBSITE

Paul W. SOWAN

This very large (8907 kb) text file of over 1,800 pages has now been updated to 23 December 2006, and will replace the existing version on the Subterranea Britannica website www.subrit.org.uk

The file includes over 34,200 paragraphs, 100,870 lines, and 844,000 words.

It is a bibliography of published works relating to economic geology especially mines and quarries working minerals (principally other than fuels or metalliferous ores) in the British Isles, including the Channel Islands, the Isle of Man, Northern Ireland, and Eire.

Metalliferous minerals are included if worked for use as compounds e.g. iron oxides (ochres) for pigments, barytes, fluorspar, etc., rather than for reduction to the metallic state.

Compiled entirely for his own purposes and convenience by SB Chair Paul Sowan, the contents are made available to other researchers 'with all faults.' Entries and corrections are made daily, and updated versions made available via the internet / world wide web from time to time. This bibliography may be of interest and use to students of applied, economic and general geology (especially mines and quarries other than for fuels or metalliferous ores), and to students of the history of geology.

SUBTERRANEA BRITANNICA CHAIRMAN WINS AWARD

The British Association for Local History makes five awards for local history publications each year. One of these for materials published in 2006 goes to Subterranea Britannica Chairman Paul Sowan, for his article 'The Croydon, Merstham & Godstone Iron Railway: a short chapter in a long story' published in the Bourne Society's Local History Records 45 (2006), 53 – 71. This relates the horse-drawn, iron tramway which operated between Merstham (east Surrey) and Croydon (Greater London) from 1805 to 1838, to a long-established trade in minerals from the Reigate area to the capital, dating from Roman quarrying of 'Reigate stone' and including the products of underground quarries, and of mines for fullers' earth and silver sand. The tramway was succeeded by the London & Brighton Railway, opened in 1841, which concern continued for a century or more to convey, especially, hearthstone from the east Surrey mines, and lime, to London.

The BALH criteria for these awards are that published work should:

- Be well-written
- Be thoroughly researched
- Be accessible
- Make good use of sources
- Take new or fresh approaches
- Be published by a local or county history organisation

The article was especially praised for the inclusion of field observations, and for its accompanying illustrations, added by Gwynwth Fookes.

The Bourne Society, possibly the largest and most successful local history society in England, deals with a number of east Surrey parishes centred on Caterham.

NAMHO MINING HISTORY CONFERENCE 15 – 17 JUNE 2007

The National Association of Mining History Organisations' 2007 Conference will be hosted by the Tamar Mining Group in association with other west of England NAMHO organisations, based at Morwellham Quay in the Tamar valley on the Cornwall / Devon borders, .

The area is noted for intensive copper, silver and arsenic mining, the Conference theme being 'Pennies to pesticides.'

As usual, the Conference will feature surface and



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underground visits, and a programme of lectures.

Subterranea Britannica is a member of NAMHO, and members interested in attending the Conference at Morwellham should register their interest online at www.tamarmining.co.uk or write to Rick Stewart at Patchway Cottage, CALSTOCK, Cornwall, PL18 9QB ((T) 01822-832748.)

NEWS – ARCHAEOLOGY

ROYAL TOMB DETECTION IN EGYPT

Detailed mapping by digitised photography and analysis of fracture patterns in rocks exposed at the ground surface have for 42 years been applied to the location of water resources, and the monitoring of pollution and tunnelling projects. The technique is now being used to assist in the location of rock-cut tombs in the Nile valley in Egypt. The men who excavated the tombs did so with reference to existing joint planes and associated zones of weakness, which made their work easier. The tombs, worked into valley sides, generally have long entrance-halls leading to burial chambers deep into the hillsides. To date, 63 such tombs have been identified in the Valley of the Kings.

SOURCE: Dwain ELDRED, 2006, Tomb raider cracks it. *Geoscientist* 17(1), page 9.

NEANDERTHAL CAVE REFUGE IN GIBRALTAR

Neanderthal man may have survived in Europe until 24,000 years ago, some 11,000 years longer than previously generally thought. Gorham's cave on Gibraltar, possibly their last European refuge, has yielded evidence for inhabitation by 15 Neanderthals.

SOURCE: Alok JHA and James RANDERSON, 2006, Neanderthal refuge. *The Guardian*, page 15.

A NEW DENEHOLE FOUND AND SURVEYED NEAR DARTFORD, KENT

A newly discovered denehole (presumed to be a medieval chalk mine) at Waterstone Park, near Dartford, has been surveyed by members of the Kent Underground Research Group.

The denehole was discovered as the result of the subsidence of a newly installed soakaway during construction work. The subsidence gave access to three chambers, with evidence for an infilled vertical shaft from which they would have been accessed. It is assumed that there are three further chambers on the far side of the shaft. No artefacts or graffiti were found. The published report includes a measured plan and sections.

SOURCE: Harry PEARMAN, 2007, A new denehole near Dartford. *Newsl. Chelsea Spelaeological Soc.* 49(1), 12 – 13.

ARCHAEOLOGICAL RECORDING OF COPPER, LEAD-SILVER AND TIN MINES IN SE DARTMOOR, DEVON

A first report has been published describing a three-phase metalliferous mining remains recording project in south-eastern Dartmoor, in the areas of Buckfastleigh, Ashburton, and Bovey Tracey. Two further areas of the Dartmoor fringes are to be surveyed in due course.

Whereas the medieval to 18th-century tin mining remains on the higher parts of the moor are readily accessible and relatively well-known and recorded, the sites in the lower fringes tend to be on enclosed private land and often hidden under heavy tree cover and undergrowth.

A desk study followed-up by fieldwork has led to an examination of 35 mines sites within an area of 174 square kilometres. The sites range from traces of unproductive trials to quite large complex sites with adits, shafts, openworks, spoil banks, engine-houses and chimneys, and buddles. The 19th-century Buckfastleigh mine appears to have been the most productive. The report includes a distribution map and illustrations showing a mine chimney at the Arundell mine, a buddle near Clearbrook, an openwork or 'gunnis' near Ashburton, and a whim engine-house at the Buckfastleigh mine.

SOURCE: Phil NEWMAN, 2006, Rediscovering Dartmoor's metal mines. *Research News [Newsl. English Heritage Research Department]* 3, 28 – 31.

PORTWALL LANE GLASSWORKS, BRISTOL

An archaeological investigation of a glassworks site at Bristol, very close to the Redcliffe Caves, has just been published in the latest issue of *Current Archaeology*, actually published in December 2006, though irritatingly 'dated' 2007! I wish the editors of serious journals would date their issues correctly. It seems more than likely that the 'Caves' were the source of at least some of the sand used in the glassmaking process, although judging by its red colour, and thus high iron content, this sand would only have yielded dark green or brown bottle-glass.

SOURCE: Bruce WILLIAMS, 2006, Portwall Lane glassworks: rescuing industrial archaeology. *Current Archaeology* 18(3)(207) (For January / February 2007), 32 – 37.



News

EXPLORATION OF A FARMYARD DRAINAGE ADIT AND CHAMBER AT RATHO, WEST LOTHIAN

Members of the Grampian Speleological Group, whilst primarily concerned with Scotland's natural solution caves, also take an interest in mines and miscellaneous underground sites of all kinds. Ian Young and John Crae have explored and recorded an underground chamber at Ratho Main Farm, with which is associated a drainage tunnel running below the Ratho Park golf course, to the south-west of Edinburgh. Archaeological features and historical records suggests that the chamber had possibly once housed a water wheel. The report includes a diagrammatic section, and a photograph.

SOURCE: Ivan YOUNG, 2006, Farmyard fun. Newsl. Grampian Speleological Group 129, page 7.

NEWS – CONSERVATION AND HERITAGE BEER QUARRY 'CAVES' BAT HIBERNATION SITE, DEVON

The Beer Quarry 'Caves' in east Devon are underground quarries for Beer Stone, a hard chalk of Upper Cretaceous age, falling within the Dorset / east Devon 'Jurassic Coast.' They certainly supplied stone in the Middle Ages for Exeter Cathedral, and other edifices. They are operated as a tourist site, and claimed by the proprietors to be of Roman origin, although I know of no more evidence for their being any more or less Roman than the 'Roman' part of Chislehurst 'Caves.' The site at Beer is being monitored by bat researchers, as the only known hibernation site for the Bechstein's bat in Devon.

SOURCE: Ian CROWE and John KACZANOW, 2007, Jurassic Bechstein's. Bat News 82, 6 – 7.

CORNWALL AND WEST DEVONSHIRE MINING LANDSCAPES DESIGNATED A WORLD HERITAGE SITE

Ten separate areas within Cornwall and west Devon, totalling 19,600 hectares of land containing the tangible remains of mining for copper, tin, and other metals in the period 1700 to 1914, have been designated a UNESCO World Heritage Site. Details appeared in a previous issue of Subterranea.

Over 70 organisations collaborated over a period of three years to prepare the case for designation, in the process amassing a very large quantity of supporting evidence. One hundred and seventy five areas worldwide have been identified as being associated with Cornish mining, as England's southwestern-most

county exported miners, mining expertise, and equipment to, especially, the Americas, Australia, and Spain.

There are now 830 World Heritage Sites, of which 24 are within the United Kingdom. Of the total, 644 are cultural monuments (such as Avebury and Stonehenge), 162 natural (such as the Giant's Causeway) and the remainder a mix of both.

Although designation of itself brings no funding, Cornwall, as England's poorest county, is expected to benefit from increased visitor numbers and investment, following its now officially prominent place on the cultural map of the World.

Further information is at www.cornish-mining.org.uk.

SOURCE: Graham THORNE, 2007, 'Cornish Mining' designated World Heritage Site. Industrial Archaeology News 140, 4 – 5.

WORLD WAR I ANTI-AIRCRAFT BATTERY AT LODGE HILL, KENT

Well-preserved standing buildings erected in 1913 for the defence of ammunition magazines at Chatham Dockyard from aerial attack by zeppelins have been described. These, at Lodge Hill and others at nearby Beacon Hill, are the first two anti-aircraft stations in the British Isles. The magazines, at Lodge Hill and Chattenden, were linked to a third at Upnor by a military railway. The stations were in use until 1916.

Source: Paul PATTISON, and Sarah NEWSOME, 2006, Air Raid Precautions. The birth of Ack-Ack: the battery at Lodge Hill, Kent. Research News [Newsl. English Heritage Research Department] 3, 42 – 43.

WORLD WAR II 'BUNKER' (OR WAS IN JUST AN AIR-RAID SHELTER) AT PITSHANGER PARK, EALING, LONDON

What has been described in the Ealing Gazette as a WWII 'bunker' in Pitshanger Park, Ealing, although perhaps in fact no more than a common-or-garden cut-and-cover air-raid shelter, has been found to be unsafe, and infilled.

The structure, the newspaper reports, was 'built as an escape option.' During the Christmas period 2006, the 'lid' of the structure collapsed, 'sparking fears that the whole thing could go at any time.' A Council spokesman reportedly said that 'the concrete top collapsed a few weeks ago and it has become a danger to residents. The Council made the decision to collapse the bunker as fixing the lid would only be a temporary solution.'



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SOURCE: ANON, 2007, WWII Bunker has its tunnels filled in. Ealing Gazette, 12 January 2007 (contributed by Michael Thomson)

SUBSIDENCE AT PECHERSK LAVRA, KIEV, UKRAINE

Parts of the 'caves' at or associated with the Pechersk Lavra (Caves Monastery) at Kiev, actually monastic catacombs excavated in loess, have reportedly collapsed. The spectacularly beautiful surface buildings are also said to be at risk from the effects of 'years of neglect, rain, snow, and rising underground water.' These comprise bell towers, churches, gates, monuments and seminary buildings.

The 'Near' and 'Far' Caves at Pechersk Lavra, when visited by your Chairman in 1996, were occupied by mummified monks (decently concealed below ornamental cloths) in glass-topped coffins, and open to the public. A supposedly 'lost' catacomb within the monastery area was rumoured still to contain World War II explosives and / or loot left by German forces. And there are several small and long-abandoned 'caves' (some still containing a few loose bones kicking about the floors) in areas outside Pechersk Lavra.

SOURCE: ANON, 2007, Ukraine: symbolic Kiev monastery crumbling, say experts. The Guardian, 6 March 2007, page 24.

SOURCE: P.W. SOWAN, 2000, Additional notes on the monastery 'caves' at Kiev, Ukraine. Bull. Subterranea Britannica 31, 34 - 38.

SOURCE: Maxim N. STRIKHAR, 2000, Problems of architectural and archaeological researches and museum management of cave monasteries at Kiev, Ukraine. Bull. Subterranea Britannica 31, 34 - 38.

THE 1920s – 1930s COASTAL SOUND MIRRORS, KENT

Anyone who chooses to take the very attractive cliff-top path from Shakespeare Cliff at Dover to the Martello Tower at Folkestone will pass on the way a fine example of a concrete inter-war sound mirror facing out to sea. Further examples of these structures are to be found near Greatstone-on-Sea near Dungeness, and also in NE England.

The mirrors were developed in secrecy during a period of 14 years in the 1920s – 1930s, and were to detect incoming hostile aircraft by reflecting the sound of their engines onto a movable microphone. It was claimed that at best these devices had an effective range of the

order of 25 miles. The research site at Denge (Greatstone-on-Sea) closed in 1937, and the system was of course rendered redundant by the development of radar, not to mention the much higher speeds of more modern aeroplanes, nor the advent of V1 and V2 rockets.

The examples at Denge include a 200 foot long curved mirror, and two concrete dishes of 20 feet and 30 feet diameter, all built between 1928 and 1939.

A number of these structures are now Scheduled as Ancient Monuments, but deteriorating in condition as a result of exposure to the weather, and subsidence caused by gravel extraction. An initiative to record and conserve the mirrors has recently been reported.

SOURCE: BRYAN, Paul, Peter KENDALL, and Alan WRIGHT, 2006, Air Raid Precautions: the 'listening ears' – a meeting of 'cutting-edge' technologies. Research News [Newsl. English Heritage Research Department] 3, 38 – 41

SOURCE: Damon SCHUNMANN, 2004, Reflecting on the past. New Civil Engineer, 19 February 2004, pages 20 - 21.

NEWS – HEALTH AND SAFETY

A CAUTIONARY TALE FROM GERMANY

A motorist who had accidentally dropped his keys down a drain on Boxing Day, 2006, removed the drain cover and endeavoured to recover them. He ended up, wedged upside down, below ground level. It took several policemen to pull him out, without his keys.

SOURCE: ANON, Man freed from tight spot after going down the drain. The Guardian, 28 December 2006, page 23.

SEWER TUNNEL COLLAPSE IN SAN ANTONIO, GUATEMALA

A dramatic photograph in The Guardian, with a short caption, shows an aerial view of a collapse crater with a diameter of the order of three times the width of a nearby road.

It is reported as a collapse into the sewerage system at San Antonio, north of Guatemala City. Three people are reported missing.

SOURCE: Orlando SIERRA, 2007, A huge hole .. The Guardian, 24 February 2007, page 25.



News**DEATHS IN A 'GAS-FILLED CAVE' IN TENERIFE
(SPAIN)**

A recent report from Madrid is somewhat difficult to interpret. It is stated that six people who were exploring 'underground caverns' on Tenerife were found dead after 'suffocating in a tunnel filled with volcanic gas.' The precise nature of the 'caverns' is unclear. The report later states them to have been man-made, but does not elaborate. Likewise the nature of the 'volcanic gas' which seems not to have been any of the 'volcanic nasties' such as hydrogen fluoride, hydrogen sulphide, or sulphur dioxide, all of which would do rather more than just suffocate. Carbon dioxide seems more probable, and is also given off from the ground in volcanic districts. However, it is also reported that a flooded chamber nearby 'smelled strongly of gas!' The reported symptoms of the survivors support the carbon dioxide possibility. Three others had evidently died in similar circumstances some seven years previously. Local emergency services suggested a lack of oxygen was the cause of death, not poisoning. High carbon dioxide levels rather than a high nitrogen / low oxygen atmosphere thus seems to be the answer, and the 'volcanic' nature of the ground irrelevant. High nitrogen / low oxygen might have been the result of organic or mineral substances in the ground removing oxygen by oxidation, but not releasing carbon dioxide in exchange. Some metallic sulphides, for example, can have that effect. The real mystery here, therefore, is the exact nature of the tunnels.

SOURCE: Giles TREMLETT, Six die as group is trapped in gas-filled cave in Tenerife. *The Guardian*, 12 February 2007, page 17.

SUBSIDENCE RISK IN MOSCOW, RUSSIA

Anxiety has been expressed that a boom in basement construction in the Russian capital has put much of the city at risk of collapse. Numbers of new underground car parks and shopping centres now underlie and threaten the stability of an estimated 15% of the city's surface. There is also a risk to the stability of existing underground cavities created by karst processes in the underlying mudstones and limestones on which Moscow is built. Natural voids from 10 to 100 metres deep are known. A significant section of the Leningradsky Prospekt main approach road subsided recently.

SOURCE: Damian ARNOLD, 2006, Basement boom could trigger Moscow collapses. *New Civil Engineer*, 5 October 2006, page 10.

NEWS – MINES AND QUARRIES**PLACE-NAME EVIDENCE FOR A 10th CENTURY
QUARRY AT MERSTHAM, SURREY**

A recently published paper identifies a 10th century (AD 967) charter for Cealvadune as relating to Chaldon in Surrey, rather than Kelvedon Hatch in Essex. 'For the first and last bounds of Merstham (M1 and M19) the old English reads 'on pone porn [? _orn] be norpan [? nor_an] Eadrices stane' or 'by the thorn to the north of Eadric's stone.' Rumble (5) argues that translation of "stane" as a place where stone was obtained is plausible here. He refers to a disused quarry, age unknown, in the approximate locality, which proves the existence of quarriable stone there. However, he does not identify a specific quarry. Of the possible quarries in this area, the most plausible one is that now hidden by Starrock Wood. The early name was 'Stanroc', which could be translated as 'Rock Quarry,' although its appearance suggests chalk. This identification is much assisted by local knowledge as the author at one time lived in Starrock Lane: Starrock Wood and Starrock Green are nearby. This identification is also supported by correspondence of this part of the bounds to those of Chaldon. For Merstham bound number 5, the Old English reads 'on essen's ham on cusessted boerh' or 'from Esne's enclosure to Cusesstede Hill.' A beorg in Anglo-Saxon was a barrow or hill of 'continuously rounded profile.'

[(5) A.R. Rumble, 1971, The Merstham (Surrey) charter bounds, AD 947, in *Journal of the English Place-Name Society* 4, pages 12 – 36.]

The location for the supposed quarry suggested by the author is on the Chalk outcrop, to the west of the A23, towards Chipstead. Chaldon's and Merstham's best-known quarries, of course, are further south, at the foot of the North Downs Chalk escarpment, tunnelled into the underlying Upper Greensand.

An open chalk pit is unlikely to have been called a quarry, or indeed a source of stone or rock. However, underground quarries for chalk are certainly known in Surrey, at Westhumble (Mickleham) and at Guildford, these being underground tunnel systems for the extraction of rectangular pieces of hard chalk for use as a building-stone. The word 'quarry' historically implied a place where dimension stone was got, whether opencast or underground. For chalk, this had to be underground, as the soft porous limestone is too deteriorated by frost action at surface.

The evidence of the Surrey quarries suggests that in east Surrey, where Reigate stone from the Upper Greensand exists in accessible places as close as possible to London, this material was preferred to



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chalk; whereas from the river Mole to the River Wey, chalk was quarried underground as building-stone. Underground quarries for chalk in east Surrey are of course possible, albeit as yet undetected. Chalk block building stone is known at both Reigate and Croydon, being generally found in interior work and below ground level (cellar floors^s and walls for example) where it is not affected by rain and frost. There may therefore be undetected underground chalk quarries in or near Croydon and Reigate, and perhaps also at Starrock near Chipstead. The only hint of underground chalk workings in these areas is a cluster of depressions generally interpreted as deneholes (agricultural chalk mines) at Coombe, to the east of Croydon.

SOURCE: Tim NORTHFIELD, 2006, Nine newly identified bounds of three contiguous manors in tenth-century Surrey charters. *Surrey History* 7(3), 144 – 150.

CHALK MINES AT READING: STATUTORY NUISANCE OR SCHEDULED ANCIENT MONUMENT?

An article published recently in *The Guardian* referred to 'labyrinths' of up to 40 known or suspected caverns. The word labyrinth seems to me to imply a network of interconnected chalk mines, whereas Reading has a number of quite separate mines. At Emmer Green, where is to be found the most accessible and best-known mine (called Hannover mine from the name of the block of sheltered housing above it), there are altogether at least three mines very close together, which were all worked as quite separate concerns. The other two, below the Scouts' land, were interconnected only during World War II, when they were used by Reading Council for secure storage.

The article refers to such places as providing 'exciting adventures for caver-types who like exploring underground' but fails to mention their archaeological and historical value. It dwells on residents' worries that further parts of Reading may suffer the fate of Field Road in the Coley district of the town where, in 2000, a number of houses in the street were severely damaged by subsidence. But makes the common mistake of representing all chalk mines as equally threatening, overlooking for example the fact that British chalk mines at Beer and Chislehurst are recognised as safe enough to be public tourist attractions!

Your Chairman wrote to *The Guardian* as follows:

Dear Sir

Chalk mines: adventure playgrounds, tourist

attractions, Statutory Nuisances or Scheduled Ancient Monuments?

Steven Morris' article (3rd March) featuring Reading's chalk mines rather conveys the impression that all such excavations present an equal and unacceptable risk to property and public safety. This is not the case.

There are chalk mines, and flint mines in the chalk, throughout most of the Chalk outcrop of southern England, from Devon through to Kent and Norfolk. They range from very numerous deneholes (especially in Essex and Kent), chalk mines, and flint mines, to industrial-scale pillar-and-stall mines, especially in north Kent. Reading's mines fall midway between these extremes. There is public access to chalk mines or underground chalk quarries (for blocks of hard chalk used as a building stone) operated as tourist attractions at Beer in Devon, and Chislehurst 'Caves' in south-east London, evidently with the full approval of HM Inspectors of Mines, who periodically inspect these places, not to mention numerous places in northern France such as Arras, Naours, and others.

In and around Reading, as in Kent, the mines are especially associated with brickfields, it being common practice right through to the 1920s to use chalk mined from below the open clay pits as an additive to the brick clay. Where, as at Field Road in the Coley district of Reading, most of the clay has been removed from above the chalk mine, surface water has been able to penetrate, leading to deterioration and failure of the chalk mine pillars and ceilings, and eventually their collapse. The construction of roads and buildings over the top may often have made matters worse, in concentrating rainwater at particularly vulnerable points. Field Road (as was also the case in the Alliance Road area of Plumstead some decades ago) is at or near one end of the spectrum of chalk mine instability. The three known mines at Emmer Green, on the north side of Reading, are at or near the other end, and comparable in stability with Chislehurst 'Caves' visited by thousands of family groups every year. The good state of preservation of the Emmer Green mines reflects the thick layer of clay left above them, which has kept surface drainage water out. Indeed, Reading Council linked two of the Emmer Green mines together during World War II for use as a secure store for civic valuables. One of Reading's mayors carved his name on the wall! The Subterranea Britannica website www.subbrit.org.uk has a good deal of information on and photographs of the Emmer Green mines.

The 'caver-types who like exploring underground' mentioned by Steven Morris include specialists in mining history who value man-made underground



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space for its archaeological and historical value. Members of Subterranea Britannica have contributed informed opinion, for example, to English Heritage's recent Monuments Protection Programme, in which historic industrial sites throughout England have been assessed and graded as potential Scheduled Ancient Monuments, in recognition of the historic importance of England's former industries. A number of such sites (underground quarries in east Surrey for example) have been recognised by English Heritage as of undoubted national importance, and appropriate for Scheduling. Chislehurst 'Caves' have likewise been suggested, although my advice has been that that extensive network of three inter-connected chalk mines is of greater interest for its World War I and World War II and tourism uses than as a well-preserved chalk mine. I have suggested the Emmer Green (Reading) and Pinner (Harrow) chalk mines as well-preserved unspoiled chalk mines worthy of Scheduled Ancient Monument status.

It is appreciated, however, that in many other instances, abandoned mines do present an unacceptable risk. Members of Subterranea Britannica, and of other British mining history organisations, for example, contributed a great deal of data on mine locations to the Review of Mining Instability in Great Britain commissioned by the Department of the Environment, published by Arup Geotechnics in 1990 – 91. That review, incidentally, concluded that there are abandoned mines of one sort or another in every English and Welsh County, and in every Scottish Region except the Western Isles.

We have a problem today because the registration of working mines, and the deposit of plans of abandoned mines, other than for coal and associated mines, dates only from the passing of the Metalliferous Mines Regulation Act of 1872. And under that Act, a plan of a mine on abandonment was required to be deposited only if 12 men or more were working underground. Many chalk mines had already been abandoned before 1872. And many or perhaps most chalk mines employed fewer than 12 men below ground. The last of them, in Kent, were worked into the 1920s. Even such official records as do survive may be difficult to trace. Details of Kent chalk mines, under the 1872 Act, for example, appear at first in the Reports of HM Inspector of Mines for Manchester & Northern Ireland, and, later, of North Wales and the Isle of Man! Despite its title, the 1872 Act regulated mines of all kinds (including building-stones, clay, fullers' earth, gypsum, hearthstone, limestone, rock salt, silver-sand, for example) as well as metalliferous ores.

Problems have been compounded by mine owners and operators who have abandoned mines and

disappeared. Shafts have been covered by old doors or sheets of corrugated iron, covered with earth! These, ultimately, collapse, with occasionally unfortunate consequences. And local authorities have not been without blame. Reading Council's predecessor (the Local Board of Health), for example, commissioned a plan of the town which has a mine shaft clearly marked on it in the Coley area, where Field Road was later laid out. A life was lost and property was destroyed at places in SE London and north Kent as local planning authorities had not troubled to keep records of mines they knew about during their active lives in the early years of the 20th century.

The answer is to maintain secure access to abandoned mines wherever feasible, and for properly equipped and knowledgeable persons to examine them from time to time, to produce accurate surveys and to monitor structural stability as well as record archaeological features. This is commonplace in France, where civic engineers' departments monitor extensive underground quarry and mine networks as at Caen, Laon, and even Paris, which has chalk mines, gypsum mines, and underground building-stone quarries below the streets. Remedial works are put in hand, relatively inexpensively, as and when and where required. In Britain, much of the monitoring and surveying is done by members of such bodies as Subterranea Britannica and local mining history groups. But the official solution, as at Combe Down at Bath for example, seems often to be to seek to fill all these extensive cavities completely – a technically difficult and very expensive operation.

Yours truly,

Paul W. SOWAN
Chairman – Subterranea Britannica

Not surprisingly, The Guardian did not publish such a long letter!

SOURCE: Steven MORRIS, 2007, Minefields for council as town asks what lies beneath. Engineers urge mapping of Reading chalk mines. Labyrinth could comprise up to 40 caverns. The Guardian, 3 March 2007, page 19.

MALTBY MINE, SOUTH YORKSHIRE, SOLD TO HARGREAVES SERVICES

Maltby colliery, one of Britain's few remaining deep coal mines, has been purchased by Hargreaves Services from UK Coal. This was the location of one of the mass protests during the miners' strike in 1984.



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Hargreaves Services are the largest independent coal importers in Britain, and were also hitherto one of UK Coal's biggest customers. The £ 21.5m deal will safeguard 470 jobs at the mine, which turned out 750,000 tonnes of coal last year, making a loss of £ 18.2m on sales of £ 32.7m. UK Coal had purchased the English coalfields when British Coal was privatised in 1994.

SOURCE: John GILES, 2007, Coal mine deal: 470 jobs saved. The Guardian, 28 February 2007, page 26.

DEATH AT DAW MILL COLLIERY, ARLEY, NEAR COVENTRY, WARWICKSHIRE

UK Coal, Britain's largest colliery operator, is to cut production for a month at its Daw Mill mine at Arley, near Coventry, following the death of a miner, Anthony Garrigan, caused by a fall of ground. Two other deaths since June 2006 have been the result of inhaling methane, and a car accident.

Source: Marianne BARRIAUX, 2007, UK Coal to cut production at Daw Mill after man dies. The Guardian, 23 January 2007, page 23.

EXHAUSTION OF GOLD RESERVES AT GWYNFYNYDD MINES ROYAL NEAR DOLGELLAU IN NORTH WALES

Welsh gold mining may come to an end in 2007. Roland Phelps, managing director of Welsh Gold, the only producer still operating, has predicted supplies will run out at some time in the coming year. He is able to be relatively precise about this, as his business depends on re-working old spoil tips, of finite and known extent and gold content, not on mining new rock. The mined 'ore' is, of course, plain rock with extremely small quantities of the metal in it, which have to be removed by crushing followed by various mechanical processes to separate the high-density material. Welsh Gold operates the Gwynfynydd Mines Royal near Dolgellau, North Wales.

SOURCE: ANON, 2006, Supply of Welsh gold likely to run out in 2007. The Guardian, 27 December 2006, page 19.

IRONSTONE MINING AT KIRUNA, SWEDEN

Kiruna, Sweden's northernmost municipality, exists and has developed essentially to provide a workforce for the vast ironstone mining complex of the state-run company LKAB. The world's 'largest underground mine' is here, at Kiirunavaara mountain. Ironstone is exported via Sweden's northernmost railway line, over the border to be shipped from the Norwegian port of

Narvik. This is all well within the Arctic Circle. The trains, it is believed, run very well through whatever kind of snow!

Unfortunately, the town has been built on top of further ironstone reserves. The municipal council decided, in January 2007, to move more than half the town from the shadow of Kiirunavaara, to the base of another mountain, Luossavaara, about four kilometres away, to allow the reserves, estimated at 800m tonnes, to be mined. Buildings will be torn down, or, if of special quality, re-located, and roads and the railway line re-routed over a period of 40 or 50 years. Mining commenced here around a century ago.

At a nearby mining town, Malmberget, to the south, several streets have become a ghost town as a result of mining subsidence.

SOURCE: Sarah EDMONDS, 2006, Half a town to move to make way for mining. The Guardian, 18 January 2007, page 15.

ILLEGAL GEMSTONES- AND GOLD-MINING IN ZIMBABWE: 16,290 PERSONS ARRESTED

Police in Zimbabwe have arrested 16,290 illegal miners, and confiscated more than 3 kg of gold, 500 tonnes of gold ore, 4,876 diamonds, and 20 emeralds from illegally-worked mines, whether opencast or subterranean is not reported. An earth tremor and the effects of dry weather had 'exposed seams of diamonds' in the Marange District. Precious minerals, under Zimbabwean law, are required to be sold through a state-controlled company.

SOURCE: ANON, 2006, Gold and gems recovered in raids on illegal miners. The Guardian, 29 December 2006, page 23.

GOLD SMUGGLERS' BATTLES WITH POLICE A MILE UNDERGROUND IN SOUTH AFRICA

South African police are arresting gold smugglers who have spent up to a year in abandoned sections of mines underground. The smugglers use home-made bombs to fend off arrest. Sixty men appeared in court recently charged with breaching mining regulations, and illegal possession of explosives. 400 kilogrammes of gold-bearing ore have been seized. It has been estimated that as much as 35.6 tonnes of gold a year is lost to the pirate miners, about one tenth of annual production.

South Africa's deepest operating gold mine is the Anglo-Gold Ashanti Tau Tona mine in Carltonville, about two miles deep.



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Temperatures of up to 38° C make the illegal mining unpleasant, and processes used by the illegal workers include the use of grinders, and of mercury-processing.

SOURCE: David BERESFORD, 2006, A mile underground, gold smugglers with home-made bombs battle police. The Guardian, 17 November, 2006, page 29.

NEWS - MISCELLANEOUS

GEOLOGICAL SOCIETY OF LONDON – 200TH ANNIVERSARY IN 2007

The Geological Society of London, established in 1807, is the world's first and oldest national geological society, with impressive apartments and a library at Burlington House, Piccadilly, London. This is the premier geological society for British academic and professional geologists, fellows being designated by the letters FGS after their names. It should not be confused (although it often is) with the Royal Geological Society of Cornwall, the Royal Geographical Society, the British Geological Survey (established as the Geological Survey of Great Britain in 1835) or the Geologists' Association, the premier national society for amateur geologists founded in 1857 (although many professionals are Fellows of the GSL, and many Fellows are members of the GA.)

All these bodies have published a great deal of information on economic geology, and have libraries containing large numbers of book, journals, and maps having a direct bearing on mines, mining, tunnels, and tunnelling.

ORDNANCE SURVEY 'EXPLORER ACTIVE' (1:25,000) SHEETS NOW AVAILABLE

For many years after their introduction, the Ordnance Survey's '2 1/2 inches to the mile' (1:25,000) were published as square sheets depicting 100 square kilometres of country on each. These were numbered according to the National Grid square represented, this system having the immense advantage that the sheet number for any particular place could be very easily worked out from any of the smaller-scale OS maps. Economics then dictated the re-issue of these maps as pairs of 100 km² sheets, and a new numbering system was introduced, which at least had a continuous sequence right across the country, although an index sheet was now needed to identify any particular sheet. Naturally, there were 'unpopular' areas, including those around the edge with rather a lot of sea, and 'boring' places like extensive stretches of flat agricultural land or the suburbs of London, where low

sales made for a poor return on the costs of production.

Most recently we have seen the introduction of huge sheets, sometimes printed on both sides, each covering many hundreds of square kilometers. And the sheet numbering 'system' is bizarre and irrational! Although maps at this scale are especially designed for walkers and cyclists, they could really only be unfolded and consulted conveniently indoors on a very large table! Trying to use such a map in the rain on a windy hill-top was more or less out of the question. Nor could it easily be done inside a car.

The Survey has now gone a small way to making these sheets more user-friendly in the field. All 403 sheets of the Explorer range are now being made available in a new 'Active' range, at a somewhat higher price. These new sheets are waterproofed and stronger, and can be written on using a suitable pen and then wiped clean again as required. At £ 13.99 each, they are recommended for anybody intending taking their maps into the field.

SOURCE: ANON, 2007, Ordnance Survey and caving. Descent 194, page 6.

HOLIDAYS UNDERGROUND

An illustrated travel feature in The Times recently offered suggestions for places holidays featuring subterranean accommodation. Amongst the caves of Cappadocia (Turkey) there are, for example, Les Maisons de Cappadoce, 'twelve beautiful cave dwellings situated in the ancient, unspoilt village of Uchisar' (www.cappadoce.com)

In France, the Loire Troglo-gite (<http://perso.orange.fr/gitentroglo/>) is on offer, with a nearby underground zoo! North-east of Granada in Spain there are underground holiday homes at Hoya de Guadix, once 'the largest community of cave dwellers in Europe.' Apartments are on offer with from one to three bedrooms.

Tunisia (www.explore.co.uk) offers underground Berber houses, and the island of Santorini (Greece) has Alexander's cliff-top cave houses, all with sea views (www.vacation.greece.com/hotels/cyc;ades/santorini/cavehouses) in Oia.

SOURCE: Louise RODDON, 2007, Going down in the world. The Times [Travel Section], 13 January 2007, page 16.



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UNDERGROUND NUCLEAR WASTE STORAGE AT ONKALA, WESTERN FINLAND

Finland has four existing nuclear power stations, with a fifth planned. Being located on one of the oldest and most stable geological districts in the world, the Baltic shield (largely crystalline gneiss and granite) it is seen to be well-placed for nuclear waste disposal.

Following 25 years of test-drilling from the surface at Onkala, work commenced in 2004 on a massive spiral tunnelling project to a depth of 420 metres, which may be extended from the initially planned 4 kilometres to 5 kilometres if found necessary in the light of rock conditions.

The tunnel, 4.5 metres high, and 5.5 metres wide, is to give access for intensive sub-surface probe drilling to allow the drawing up of a very detailed map of the geology and structure of a substantial volume of sub-surface rock within which waste disposal tunnels and shafts can be excavated. This main tunnel, descending at a gradient of 10%, would in due course serve for access to the planned grid of disposal tunnels four or five kilometres below the surface. The first of two planned vertical shafts, 3.5 metres in diameter, has also been commenced, and a second wider one planned, to accommodate escalators and provide for ventilation. Completion of this phase of exploratory work is expected in 2010. If the results of examination of the rock are satisfactory, driving some kilometres of parallel depository chambers may commence in 2015, with completion expected a century later. Remains of fuel rods immobilised in ceramic, packed in copper cylinders, are proposed to be deposited in 7.5 metre deep disposal shafts in the chamber floors, and surrounded by bentonite clay as a shield against ground-water penetration

The site is near an existing nuclear power station, and the municipality of Eurajoki.

SOURCE: Adrian GREEMAN, 2006, Onkala below. New Civil Engineer, 30 November 2006, 24 – 26.

NEWS – PUBLICATIONS

EAST SURREY UNDERGROUND

Peter Burgess, a leading light of the Wealden Cave and Mine Society, has recently published a book, East Surrey underground, the inspiration for which is stated to have been the similar Kent and East Sussex underground (published by Meresborough Books in 1991), a compilation by a number of members of the Kent Underground Research Group, assembled and edited by Adrian Pearce.

The author of the present work has been actively engaged in researching the mines, underground quarries, and other man-made and natural underground spaces of east Surrey for some decades, and has a number of published papers to his credit which combine underground exploration, careful archaeological recording, archival and oral history recording and research, and a high degree of intelligent interpretation of the available mass of evidence.

The contents list reveals there to be chapters devoted to safety, sand caves and mines, firestone quarries, hearthstone mines, underground mushroom farms, wartime secondary use of underground space, deneholes, fullers' earth mines, subsidences, the swallow-holes of the river Mole, early exploration, rumours and myths, and conservation (both of archaeological features and of bats and other wildlife.)

The paperback book has an attractive colour photograph taken inside one of Reigate's silver-sand mines, and a number of black-and-white photographs and line drawings (location maps, mine plans and sections, finds, and so forth.) The style adopted for the text is accessible, and although the author has consulted virtually every currently known archival and published source, he has chosen for this popular but authoritative publication not to include detailed reference to sources, but there is a good index.

This is not a do-it-yourself guide to underground exploration for beginners, who are advised to put their interest in the subject into practice via membership of an established caving or mining history society, as such bodies will have organised access agreements with land-owners and occupiers. For this reason, exact locations and details of access are often not included, as owners and occupiers generally prefer to deal with organisations having appropriate equipment, expertise, and insurance cover. The message is simple enough: those who wish to visit the underground sites featured here should seek to do so as members of an appropriate society.

This highly recommended and important book is at present available, at £10.50 per copy inclusive of postage and packing, only from the author:

Peter M. Burgess, 8 Trotton Close, Maidenbower, CRAWLEY, West Sussex RH10 7JP

Reference: Peter M. BURGESS, 2006, East Surrey underground. Crawley: published by the author: 121pp.



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**PROCEEDINGS OF THE UNIVERSITY OF BRISTOL
SPELAEOLOGICAL SOCIETY 24(1) (2007)**

The latest issue of the Proceedings of the University of Bristol Spelaeological Society 24(1) (2007) contains the following papers:

BUNCE, Colin, 2007, Whelan's Quarry Cave, Co. Clare, Ireland. Proceedings of the University of Bristol Spelaeological Society 24(1), 71 – 74 [Otherwise Poullee Cave, NW of Ennis]

DONOVAN, D.T., 2007, Gough's Cave, Cheddar, Somerset: Quaternary stratigraphy. Proceedings of the University of Bristol Spelaeological Society 24(1), 17 – 35.

FINDLAY, D.C., and J.A. CATT, 2007, A temporary section in Head at Bourne, Burrington, Somerset. Proceedings of the University of Bristol Spelaeological Society 24(1), 5 – 15.

MULLAN, G.J., L.J. WILSON, A.R. FARRANT, and K. DEVLIN, 2007, A possible engraving of a mammoth in Gough's Cave, Cheddar, Somerset. Proceedings of the University of Bristol Spelaeological Society 24(1), 37 – 47.

MULLAN, G.J., 2007, Radiocarbon dates from Tynning's Great Swallet, Charterhouse-on-Mendip, Somerset. Proceedings of the University of Bristol Spelaeological Society 24(1), 49 - 52.

SELF, C.A., and A. BOYCOTT, 2007, Landslip caves of the northern Cotswolds. Proceedings of the University of Bristol Spelaeological Society 24(1), 53 – 70 [Gloucestershire / Oxfordshire]

**PIDZEMNIA DIVOSVIT TERNOPILLYA,
IN UKRAINE**

Recently received from our good friends in the Chortkiv Speleoclub Crystal, this very attractively produced A5 booklet (all in Ukrainian) has a cover title (transliterated into Roman letters) Pidzemnia Divosvit Ternopillya which, I guess, translates as Underground Marvels of the World in the Ternopil Region.

The 48 pages are devoted to descriptions, and excellent colour illustrations, of 'Christal cave, Mlynky cave, Optimistic cave, Vertebe cave, and Ozerna cave.' These are, by and large, natural solution caves in gypsum, some of which have to some extent been used by man as dwelling-places, part of a monastery, or for small-scale gypsum mining.

**STONETROUGH & MOW COP TRAMWAY TUNNEL
OF 1842 – 87 IN THE BIDDULPH VALLEY,
STAFFORDSHIRE**

Robert Williamson's Stonetrough & Mow Cop horse-drawn tramway linked Stonetrough colliery with the Macclesfield Canal (opened in 1831), operating from 1842 to 1887. The line included a single bore single track tunnel, 370 yards long and of eight feet diameter, which was partly lined and had a circular chamber of unknown purpose within its length. A recent paper includes a plan of the tunnel and a photograph of one of the portals, and suggests that the circular chamber may have been built in response to weak or faulted ground, or was perhaps (although it seems unlikely) turning waggons. However, why anybody would want to turn a waggon round midway through a tunnel is not at all clear. And presumably this would apply only to single waggons, which would have to be disconnected from the horse, not to trains of waggons. The tunnel is NE of Mount Pleasant.

SOURCE: Derek WHEELHOUSE and Paul BLURTON, 2007, Early rail transport in the Biddulph Valley. JI. Railway and Canal Historical Society 35(7)(197), 509 – 517.

NEWS – TUNNELS AND TUNNELLING

**LONDON UNDERGROUND TRAINS TO BE
TESTED AT THE FORMER BRITISH RAIL OLD
DALBY TEST TRACK, RUTLAND**

The 21 kilometre Old Dalby test track, owned by the British Railways Board (Residuary) was mothballed in 2005 following test-running of Virgin Trains' Pendolino rolling-stock. It is now to be brought back into use by Metronet Rail for testing new tube train stock. At least four kilometres are to be electrified on the London Underground 3rd and 4th rail system. The existing running rails are to be retained, their 'used and worn' condition being ideal to 'maximise the endurance testing of the new trains.' The expectation is that at Old Dalby, six months' or a year's service running can be simulated in a month.

Using Old Dalby has the additional advantage over night-time use of existing LU lines that these will be more readily accessible for the maintenance and upgrading of infrastructure and signalling.

The test track occupies the former line between Melton Mowbray and Nottingham (Midland), branching off northwards to the west of Melton Mowbray station, and includes in its length four tunnels (Ashfordby tunnel, 419 yards; Saxelby tunnel, 543 yards; Grimston tunnel, 1305 yards; and Stantont



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tunnel, 1330 yards), as well as the 100 yards Saxelby covered way. The several stations along this line closed at various dates from the 1940s (Old Dalby itself, which had opened in 1880, in 1966), and the line itself closed to public traffic in 1968 and 1969.

SOURCE: ANON, 2007, Metronet to reopen Old Dalby test track. Modern Railways 64(702), page 6.

SOURCE: M.H. COBB, 2005, The railways of Great Britain: a historical atlas. Revised edn. [ISBN 0-7110-3002-2]

SOURCE: John YONGE and Gerald JACOBS, 1990, British Rail track diagrams. 4. London Midland Region. Exeter: Quail Map Company.

CHANNEL TUNNEL RAIL LINK TO BE RENAMED HIGH SPEED 1: OPENING TO ST. PANCRAS INTERNATIONAL EXPECTED 14 NOVEMBER 2007

London Waterloo International station is expected to close after the arrival of the last Eurostar evening train from mainland Europe on 13 November 2007. London St. Pancras International will open for the first departures to Brussels and Paris early the following morning. Journey times will be cut by 25 minutes, giving fastest time to Lille of 1 hour 20 minutes, Brussels 1 hour 51 minutes, and Paris two hours 15 minutes. Test trains are already running to and from St. Pancras.

SOURCE: Ken CORDNER, 2007, High Speed 1 – eight months until opening. Work on the Channel Tunnel Rail Link – which has been re-named High Speed 1 – is in the final stages. Modern Railways 64(702), 38 – 43.

DOCKLANDS LIGHT RAILWAY EXPANSION, LONDON

The Docklands Light Railway carried 60 million passengers in 2005. This is expected to increase to 80 million in 2009, when the next extension under the Thames to Woolwich Arsenal opens. And even further in 2010, on completion of an extension to Stratford International, which will be served by Eurostar trains on the re-routed Channel Tunnel Rail Link.

SOURCE: John SULLY, 2007, DLR expansion continues. Modern Railways 64(702), 34 – 35 [Docklands Light Railway]

MIDLANDS AND NORTH TO BRUSSELS AND PARIS BY AIR AND TRAIN COMPARED

Sample figures have been released for journey times

and frequencies from Midlands and the North to Brussels and Paris by Eurostar trains running via the Channel Tunnel on the opening throughout of the Channel Tunnel Rail Link (now called High Speed 1) on 14th November 2007.

	Journey Time by rail hrs-mins	Time by air hrs-mins	Departures week by rail	Departures week by air
Leicester - Brussels *	3/36	348	52	16
Derby - Paris*	4/20	3/49	59	13
Sheffield - Brussels **	3/57	4/19	47	16
York-Paris **	4/11	4/23	79	25

* East Midlands Airport

** Leeds / Bradford Airport

The re-location of Channel Tunnel / Eurostar rail services from Waterloo to St. Pancras will obviously make for quicker and more convenient breaks of journey at London, with domestic High Speed Train services from St. Pancras (Midland Mainline) and adjoining King's Cross (East Coast Main Line.)

There are already, of course, convenient connections at Lille, Brussels, and Paris, with well-established TGV and Thalys high-speed services to cities in Belgium France, Germany and the Netherlands.

SOURCE: Richard BROWN, 2007, Eurostar: what next? Richard Brown, Chief Executive Officer of Eurostar (UK) Ltd, told the Railway Study Association about his plans for using HS1. Modern Railways 64(702), 46 – 49.

TYNE & WEAR METRO UPGRADE PROPOSED, NEWCASTLE-UPON-TYNE

The Tyne & Wear Metro is now over 25 years old and due for an overhaul, including work in the tunnels. A business case for a £ 600m upgrade was taken to the Government in January 2007,

SOURCE: ANON, 2007, Nexus puts case for £ 600 million Metro reinvigoration. Modern Railways 64(702), page 7.



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THIRD THAMES CROSSING AT DARTFORD (KENT) – BRIDGE OR TUNNEL?

Preliminary consideration is being given to a third Dartford road crossing, whether a bridge or a tunnel is not yet determined, to link northern Kent with southern Essex. Possible locations are either close to the existing bridge and tunnel, or further downstream at Gravesend, Swale, or the Isle of Grain.

SOURCE: Damian ARNOLD, 2006, Case for Third Dartford Crossing "indisputable" say engineers. *New Civil Engineer*, 26 October 2006, page 10.

NEW SEWER TUNNELS FOR MARGATE, KENT

A £ 66m wastewater treatment project comprising more than two kilometres of tunnels, open-cut pipe-trenches, a new treatment works, and complex marine engineering, planned to be operational shortly, features a pipeline route across the Isle of Thanet from Margate via the eastern end of the runways at Manston Airport to Weatherlees to the south.

SOURCE: Damian ARNOLD, 2006, Beside the seaside: Margate will soon benefit from one of the UK's most advanced wastewater treatment schemes. *New Civil Engineer*, 12 October 2006, 26 and 28.

HINDHEAD ROAD TUNNEL CONFIRMED (SURREY)

Approval for the burial of a part of the A3 at Hindhead was confirmed by the relevant Secretary of State in October 2006. The scheme is estimated to cost £ 371m, and will remove the blight of a main road crossing an elevated and conspicuous part of the Surrey Hills Area of Outstanding Natural Beauty. This will doubtless also please those of the motoring fraternity who think only of getting from A to B as quickly as possible, without regard for the quality of life of those between their starting points and their destinations. The abandoned length of road over the top of the hill will be restored to nature at this famous beauty spot, the Devil's Punch Bowl. The scheme has had the support of the National Trust, the Surrey Hills AONB Executive, Natural England, and other amenity and conservation organisations.

Construction is expected to start in April 2008, and will eliminate the last single-carriageway section of the A3. The tunnel will be a twin-bore structure, and 1.9 kilometres long, and is expected to be open in 2011.

SOURCE: ANON, 2006, Green light for Hindhead tunnel. *New Civil Engineer*, 2 November 2006, page 10.

PLANS FOR REPLACEMENT OF TESCO'S ILL- FATED TUNNEL AT GERRARDS CROSS (BUCKINGHAMSHIRE) OVERDUE

The collapsed cut-and-cover tunnel built over Chiltern Railways' main line at Gerrards Cross in connection with the proposed building of a new TESCO's supermarket looks no closer to reconstruction. Plans, it was reported in September, have yet to be submitted to Network Rail for approval.

SOURCE: ANON, 2006, Gerrards Cross tunnel: still no plans submitted. *New Civil Engineer*, 21 September 2006, page 8.

LONDON UNDERGROUND JUBILEE LINE 'SEVENTH CAR' PROJECT

Previously six-carriage trains on the Jubilee Line of London's Underground railways were lengthened to seven carriages with effect from the start of 2006, necessitating the lengthening of some platforms and alterations to the signalling equipment.

SOURCE: Ruby KITCHING, 2005, Extra carriages prompt Jubilee Line makeover. *New Civil Engineer*, 15/29 December 2005, page 12.

LONDON UNDERGROUND'S 'BALLAST HOOVER'

London's Tube Lines is taking delivery in January 2007 of a £ 1m 'vacuum excavation machine,' purpose-made for use in tunnels, manufactured by DISAB Vacuum Technology AB of Sweden. Hitherto a similar 'Tubovac' machine has been used, which, with a crew of six, can lift 20 cubic metres of ballast per hour. Previously, teams of 12 lifted ballast by hand, achieving about a third of this rate. 'Vacuum' lifting is especially effective around complicated trackwork such as crossings and points, and virtually eliminates the risk of damage to signalling cables. The same machines can also be used to clear blocked drains and culverts,

SOURCE: ANON, 2006, Ballast hoover for tube lines. *Modern Railways* 64 (700), page 13 [This is the issue 'for January / February 2007', actually published in December 2006]

RESTORATION OF THE HUDDERSFIELD AND ROCHDALE CANALS, INCLUDING THE STANDEGE TUNNEL, LANCASHIRE AND YORKSHIRE

The restoration and re-opening of the South Pennine Ring of canal waterways has been described in some detail in *Civil Engineering*. It is now possible again,



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after some 50 years, to take a canal boat along the Huddersfield Broad and Narrow Canals, through the Standedge tunnel, via the Ashton Canal into Manchester, then via the Rochdale Canal through Oldham, Rochdale and Halifax and the Calder and Hebble Navigation back to Huddersfield. The Standedge tunnel is, at 5km, the longest canal tunnel in the British Isles: 16,000 cubic metres of silt were pumped from it. Silt in the Greater Manchester was found to be contaminated with carbon disulphide, and particularly flammable and toxic liquid, and 150 abandoned cars were fished out of the water. A total of some 520m of new cut-and-cover tunnels have been created where more modern construction had blocked parts of the route.

SOURCE: Keith PAYLOR, Mike MARSHALL, and Chris WEARNE, 2004, Full circle for UK canals: restoring the South Pennine Ring. *Civil Engineering* 157(3), 116 – 124.

THE 'BIG DIG' JACKED HIGHWAY TUNNELS AT BOSTON, MASS., USA

Interstate Highways 90 AND 93 have been brought into, through, and to a large extent under Boston, Mass. The massive road-building scheme at the heart of the city has been likened to 'prolonged urban open-heart surgery' with 12 kilometres of new highway, some 50% of it in tunnels. A 1950s flyover has been demolished and replaced by a cut-and-cover tunnel on the same alignment.

An especially noteworthy aspect of the Big Dig, as it is known locally, was the driving, by jacking, of three very large concrete box tunnels below operational railway lines without disrupting train services. The open-ended 'boxes' were forced through the ground below the railways by powerful jacks. They are up to 24 metres wide, 12 metres high, and have lengths of 51, 79, and 115 metres. This project is seven times larger than any comparable UK installation, and ten times larger than any in the USA. A much smaller and less complex tunnel-jacking operation was conducted on the recently re-routed A23 at Coulsdon recently, where a large concrete box tunnel was jacked through a chalk embankment on the Purley to Tattenham Corner railway without interruption to train services; this is at the south end of Smitham Station.

At Boston, the ground to be tunnelled was rather more challenging than the chalk rubble at Smitham. The top layers, from 6.1 to 7.6 metres thick, consisted of made ground containing the remains of Boston's waterfront and urban development over two centuries. Below this were peat and organic silts, 3.0 – 4.1 metres thick, overlying blue marine clay. Groundwater in the area

lies from 1.8 to 3.0 metres below ground level. The ground was stabilised by freezing at -30° C using liquefied ammonia gas and a calcium chloride solution.

As each box section was driven, from a launch pit, into the ground, the material was mined-out ahead of its leading end.

SOURCE: Alan POWDERHAM, Chris HOWE, Anthony CASERTA, Douglas ALLENBY, and John HOPKINS, 2004, Boston's massive jacked tunnels set new benchmark. *Civil Engineering* 157(2), 70 – 78.

THE ØRESUND LINK TUNNEL AND BRIDGE FROM DENMARK TO SWEDEN

The Øresund Link is a composite sea crossing comprising a bridge and a 1350m immersed tube tunnel from Kobenhavn to Malmö. It is featured, with aerial photographs and maps, in a recent paper in *Civil Engineering*.

SOURCE: ABBOTT, Michael, 2007, Managing the inner world of infrastructure. *Civil Engineering* 160(1), 26 – 32.

SMUGGLERS' TUNNELS UNDER THE EGYPT / GAZA BORDER

Numerous smugglers' tunnels have been dug from the outskirts of Rafah (Gaza) to Egyptian territory on the far side of the heavily protected international border. These have been described, with two photographs taken underground, and a schematic map and cross-section, in *The Guardian*. The border is described as a 100-metre wide strip of bulldozed former streets and buildings, with a security fence each side.

The tunnels, used for smuggling arms and cigarettes, are often driven from the basements of some of the ruined buildings, and have been developed during the last 20 years or so. The schematic map suggests there to be at least 12 tunnels, although a total of 80 'main' tunnels has been claimed. One tunnel is said to be about 170 metres long, through sandy ground.

One tunnel commences from a collapsed house in Rafah, 30 metres from the nearest border fence. A five-metre deep shaft communicates with a horizontal tunnel about 60 cm by 70 cm. Ventilation is provided by vacuum cleaners, and a telephone line is installed. Lighting is provided and narrow-gauge railway tracks are laid in some of the tunnels. At first mostly driven for tobacco and coffee smuggling into Gaza, the tunnels are now more often used for the illegal importation of guns and ammunition. Authorities on the Egyptian side attempt to prevent the trade by piping poisonous



News

gas into any tunnel exits discovered.

SOURCE: Conal URQUHART, 2007, Palestinian border: tunnels for hire as Gaza's smugglers risk their lives. The Guardian, 17 January 2007, page 17.

RAILWAY TUNNEL ACCIDENTS IN ICELAND!

Iceland has no public railway system. In the 1930s the Althing (claimed to be the oldest-established parliament in the world) voted down a proposal for a line from Reykjavík to Thingvellir, on the grounds that railways were 'not poetic.' There was a short narrow-gauge line along the harbour at Reykjavík for shifting goods about, and the only two locomotives ever to reach Iceland are both still preserved in the capital. A modern proposal for a monorail to link Keflavík airport with Reykjavík has not, as far as I know, been implemented. The population (a little over 268,000) is too small, the towns too small and too far apart, and the landscape (largely mountainous) too difficult for a railway system to be affordable. It is actually cheaper to fly some internal routes than it is to do the same journeys by bus. And in fact Iceland, one of the very few places to benefit from World War II, had no proper motorable road network, and almost no airfields, until

these were built by the occupation forces (British and American) in the early 1940s.

However, there are now numbers of large civil engineering projects throughout the mountains and deserts, including new road tunnels, and several very large hydro-electric power stations, many of which incorporate tunnels to convey water. During construction, these tunnels are convenient weatherproof routes for contractors' narrow-gauge railways for spoil removal, and materials movement. The massive dams and power houses are generally built in very remote and hostile environments in desert and mountain areas.

Sadly, there have been four accidental deaths and seven injuries at the Karahnjúkur project since construction commenced in 2003. In July 2004 a train crash in a headrace tunnel injured three workers, and another injured one man in a collision in a tunnel in July 2005. The four deaths, though, were at surface sites.

SOURCE: Bernadette REDFERN, 2006, Global dam engineers condemn Iceland dam deaths. New Civil Engineer, 14/28 December 2006, page 7.

Uncle Joe knew where you lived The story of Soviet mapping of Britain (part II)¹

By John Davies - Previously published in "Sheetlines" the magazine of the Charles Close Society

According to BBC radio recently,² the Red Army was poised to launch an invasion over Blackpool beach in 1976. This was the supposition of the presenter, Henry Dodds, and his interviewees after examining the Soviet military map of the town. Whilst this is probably not strictly true, it illustrates the excitement generated when one encounters these unfamiliar maps of familiar places.

The Soviet maps are indeed fascinating and the level of detail and the accuracy is quite staggering. The more one studies the maps, the more questions they raise. In the previous article we described the scope of the global mapping project in general and the maps and town plans of Britain in particular. Here we concentrate on the town plans to try to answer the question 'How did they do it?' and more specifically, 'Does the claim that the mapping "is almost entirely an adaptation of Ordnance Survey material"³ stand up to scrutiny?'

The entire Soviet mapping project was a military secret, so any attempt to say what was done and how is inevitably based on circumstantial evidence and speculation. For that reason, it must be emphasised that what follow are the personal opinions of the writer, based on study of the maps and first-hand oral information.

The emergence of the maps

Before discussing the content and sources of the maps, it is interesting to note how they come to be available in the west today.

During Soviet times, maps (at all scales of all world locations) were stored in 25 military depots throughout the USSR, where they could be quickly accessed by locally-based officers if needed. When the USSR collapsed in 1992, the fate of these maps depended on where they were stored.

¹ Part I appeared in Subterranea 12.

² 'Balalaikas in Blackpool' presented by Henry Dodds, broadcast on BBC Radio 4 on 9 May 2005.

³ Ordnance Survey statement to British Cartographic Society, September 1997, has been moved and is now at <http://www.cartography.org.uk/Pages/Membership/DesignG/Copyrit5.html>.



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Those in depots in Belarus, Russian Federation and Ukraine remained under Russian control. Gradually channels of communication were established with dealers in US in order to start earning hard currency. Those dealers, notably Omni Resources and East View Cartographics, acquired large volumes of paper maps and subsequently sold them to libraries and collectors in the west and continue to make soft copies available through the Internet.⁴ The Russian government restricted what was made available and, for example, maps of Russian territory at 1:50,000 and larger were not released.

It was a different story in Latvia, though. In 1993 Aivars Zvirbulis, a keen orienteer in the town of Cesis, 100 km east of Riga, had acquired a second-hand printing press in order to print orienteering maps and a catalogue for an artist friend. He heard a rumour that a couple of Russian officers were disposing of quantities of waste paper for pulping. On investigating, he learned of the existence of the Soviet map depot and discovered that its complete contents, over 6000 tonnes, had been ordered to be destroyed. He was intrigued and negotiated with the officers to buy about 100 tonnes. These were moved by palette load to the yard of his printing house where, unfortunately, neighbourhood children set fire to them. Only two or three tonnes were saved and of the surviving stock, many were training maps or were not of interest (Aivars was particularly interested in large scale maps of Baltic countries and western Europe and smaller scale maps of elsewhere).

He showed some of the maps at a 1993 cartographic conference in Köln, attended by some Russian visitors, former KGB officers, who were astonished to see them. They threatened to cause real trouble, but were powerless to do so.

Aivars went on to start the Jana Seta map shop and publishing company. The Soviet maps were not intended as a core part of the business and he sold them cheaply – and continues to sell the remaining stock to this day at €2 each at the shop in Riga.⁵

The other Baltic city where the maps are available is Tallin where Aleksander Lesment, a former Soviet 'officer-topographic' who came to Estonia in 1993 can supply small scale maps of much of the world in paper or electronic form.⁶

How were the maps compiled?

One simple explanation could be that they were largely copied from Ordnance Survey maps. That is what the OS stated in 1997 when they effectively banned them by declaring that they contravened Crown Copyright. However, consideration of how the Soviets went about things and close examination of the content convincingly suggests otherwise.

For an understanding of the effort the USSR military invested in the world mapping project, the story appearing in *On-Line Pravda* in February 2003⁷ is instructive. This describes the shock caused in Sweden by the recent publication in the newspaper *Aftonbladet* of illustrations of Soviet maps, dated 1987, of Stockholm and Karlskrona (the main Swedish naval base). The detailed maps were of very high quality ('better than the creations of the best Swedish military mappers') and showed all defensive installations and depths of secret waterways.

The story continues :

The publication in the Swedish newspaper ruined two myths at once: the Swedish production is always of better quality against the Russian one, and Sweden managed to conceal very important information about its coastal defence from Russians. The published maps contained the information even about the berth length and the depth at secret naval bases, not to mention the location of secret mine fields. Christer Holm, a military intelligence chief, had to acknowledge that it was the first time, when they saw such revealing information about Karlskrona army base. He added that the maps were most likely drawn on the base of secret agents' information.

Tore Foshberg, the retired chief of the counterintelligence department of the Swedish secret police, told reporters about the way the exposed maps were drawn up. Russian Central Intelligence Administration and KGB agents (there were up to 45 of such agents at the Soviet Union embassy in Stockholm) would go on a tour around the country. During their short journeys they would check loading capacities of bridges, they would also measure the distance between trees in a forest. Such information was necessary to plan the moves of the Soviet incursion army on the territory of Sweden. Soviet diplomats would arrange picnics in the places of strategic interest, they would be very friendly and sociable to the local population. "One of them, military attaché Pyotr Shiroky, went to a beach near Stockholm one fine day in the summer of 1982.

4. Omni Resources, www.omnimap.com; East View Cartographic, www.cartographic.com.

5. Thanks to Aivars Beldavs of Jana Seta map shop, Riga for this information. Contact him at aivarsb@kartes.lv. Jana Seta web site is at www.kartes.lv.

6. Eastnor Ltd, PO Box 3191, 10505 Tallinn. Contact Aleksander Lesment at lah@hotmail.ee.

7. see <http://all.newsfromrussia.com/society/2003/02/21/43579.html>.



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On that beach he started a conversation with an excavator driver (as if incidentally), who was resting on the sand nearby. As it turned out, the driver dug trenches for the cables, which were connected to mine fields. However, there was a Swedish secret agent on the beach too. He heard the entire conversation", Tore Foshberg remembers.

The article goes on to describe the origins of the KGB agents in Sweden :

It is curious that KGB and Central Intelligence Administration used a specific category of so-called duplicate people in order to 'set up the intelligence network in Sweden. In the 1930s thousands of communists with their families emigrated from Sweden to the USSR. They came to live in the Soviet Union, because they admired the new country. However, romantic foreigners' lives in the Soviet Union ended up in a very sad way: they were killed in GULAG (a system of Soviet concentration camps). However, a lot of their children survived the horrific period of the Soviet history. They started going back to Sweden in the 1960s. Some of them left Sweden when little babies. Their relatives were left to take it for granted that a grown up man, who came back home all of a sudden, was that very 'baby Sven,' whose communist parents left for the USSR years ago.

As a rule, those new Swedes did not speak Swedish very well. It was an absolutely natural thing for children, who lived in the Russian environment, and who lost their parents at a very young age. As a matter of fact, there could be no better way to send secret Soviet agents to Sweden under the disguise of re-emigrants. The newspaper Dagens Nuheter has recently published a story about one such agent, 33-year-old Karl Ulof Svanson. He was born already in the USSR, but then he returned back to Sweden in 1961. His relatives were so happy about his return; they could never imagine that Karl was actually a KGB major. Karl lived in Sweden for several years and then disappeared as suddenly as he appeared there. The Swedish counterintelligence managed to learn about him incidentally, from the memoirs of a former senior KGB agent, who escaped to the West.

Tens of agents like Karl were supposed to work on the preparation of the Soviet Union incursion in Sweden. They would check their data over and over again, collecting the information for drawing up detailed maps of the country.

Interestingly, the maps which caused the shock in Sweden had been picked up 'for a dollar' in Riga. Turning to the UK, we have no evidence of Soviet

picnics in Kent, but it is surely probable that similar efforts were made. The Chatham map, for example, shows not only the full details of the Royal Naval Dockyard and the river depths, but also the dimensions, river clearance, carrying capacity and construction of the Medway bridges.

The Radio 4 program included an interview with Oleg Gordievski, former head of KGB station in London (and later defector). He claimed to know nothing about the maps and, shown an example, said he had never seen such a map before. It is impossible to know whether or not this is true.

There are about eighty known British and Irish town plans at scales of 1:10,000 or 1:25,000, mostly dated between about 1970 and 1990. We have examined many of these to derive the hypothesis given below. Plans of other European cities such as Calais, Copenhagen, Helsingborg, Helsinki and Santander and several in India have also been studied for comparison.

The style of mapping and the use of colours, symbols, naming conventions and so on are identical for all the maps for the entire twenty-year period. The Indian cities have fewer street names, but otherwise it is not possible to identify the country or the city without translating the name. This suggests that the cartography was done to a very tight specification using a standard set of information gleaned in each country. Obviously publicly available local mapping would be of very variable quality; possibly the Russians assumed that it would be falsified, as theirs was. It is likely, therefore, that such local maps (including OS maps) were largely ignored. Assuming that the picnicking diplomats didn't carry theodolites and plane-tables, then how were the maps created? The following set of assumptions has been evolved and tested against the British town plans and is now offered as a working hypothesis. Below is a summary of the findings and an explanation of how they were arrived at. The Dublin map largely conforms, but has some odd attributes which are discussed later.

Summary of probable sources of map content

The following list shows the probable derivation of the various types of content of the maps:

1. General topography and layout of roads, built-up areas, fields, forests, quarries etc: aerial reconnaissance.
2. Road classification and numbering: probably road atlases with supplementary information.
3. Outline of coasts, rivers, lakes, canals, etc: aerial reconnaissance.



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4. Railways and ferries: largely derived from 1920s County series six-inch maps.
5. Spot heights, bench marks and contours: derived from 1920s County series six-inch maps.
6. Place names: local street atlases.
7. Annotated details e.g. widths, heights, clearance etc: probably visual inspection.
8. Hydrographic information: unresolved.
9. Proposed roads, etc.: unresolved.
10. Index of 'strategic objects': local investigations, trade directories and other publications.
11. Descriptive text: local investigations, trade directories and other publications.

Explanation of these findings

General topography and layout of roads, built-up areas, fields, forests, quarries etc.

In general, the features shown on the Soviet maps do not correspond to those shown on Ordnance maps which were then currently available. Typically, new developments or specific details appear on the maps which do not appear on OS maps until later revisions. Just a few examples will suffice to illustrate this:

- Blackpool (compiled 1974, printed 1976) shows fourteen such features which do not appear on OS until 1977 or 1981 editions (or, in some cases, at all).
- Cambridge (compiled 1986, printed 1989) has eleven, including the Cambridge Science park which first appears on OS town plan of 1995.
- Oxford (compiled 1972, printed 1973) has at least six examples.

The only reasonable explanation for this is that the topography and layout of roads and towns is based on aerial surveillance, either satellite imagery or high-altitude 'spy planes'. The technology is known to have existed at the time, as the 'U-2' incident demonstrates. (The US was operating high altitude reconnaissance flights over the Soviet Union using U-2 spy planes. On 1 May 1960, a U-2 piloted by Gary Powers was brought down, causing a major diplomatic incident and lasting damage to US/USSR relations). The first Soviet spy satellite (the Zenit) was launched in 1962.

More evidence that the maps are based on aerial images rather than published material comes from the Bournemouth map. There are actually two versions of this, one at 1:10,000 scale (compiled 1972, published 1974) the other at 1:25,000 scale (compiled 1984/6,

published 1990). Both maps show a non-existent road parallel to Burton Road, Poole (*Fig. 1*). This does not appear on any map or street plan, but perusal of an aerial view in *GetMapping.com* reveals garden boundary hedges which look as if they could enclose a roadway.⁸

Incidentally, the Oxford map, although compiled in 1972 does not show the Marston Ferry link road which opened 1971, implying that the aerial images pre-date this (or possibly carelessness).

Road classification and numbering

The Soviet maps show European road numbers which do not appear in British maps but are found on official lists and some European road atlases.⁹ For example, the London map (printed 1985) names the M11 as both 'M11' and 'E112', the A12 as '12' and 'E8' and the A127 as '127' and 'E108'. In fact, these particular E numbers were officially abandoned in 1983. There are also some examples of wrongly numbered roads, for example:

- Chester map has A51 east of the city named as '55'.
- Huddersfield map has A643 east of Outlane and A640 west of Outlane both named as '13'
- Glasgow map has A740 shown as 'T40'.

Otherwise, the numbering of A roads (omitting the A prefix), trunk roads with T suffix and motorways is generally similar to that shown on widely-available road atlases. Motorway junction numbers are not shown.

Outline of coasts, rivers, lakes, canals, etc

As with general topography, the depiction of water features does not directly correspond with OS maps, suggesting that these also are derived from aerial reconnaissance. A few examples are :

- Glasgow: banks of Clyde estuary not as OS.
- Blackpool: shape of Marton Mere and surrounding drainage channels not as OS.
- London (printed 1985): has water filled sandpits in Roding valley (alongside M11) which are not shown on 1983 OS maps but are on later versions (Figs. 4, 5).

Railways and ferries

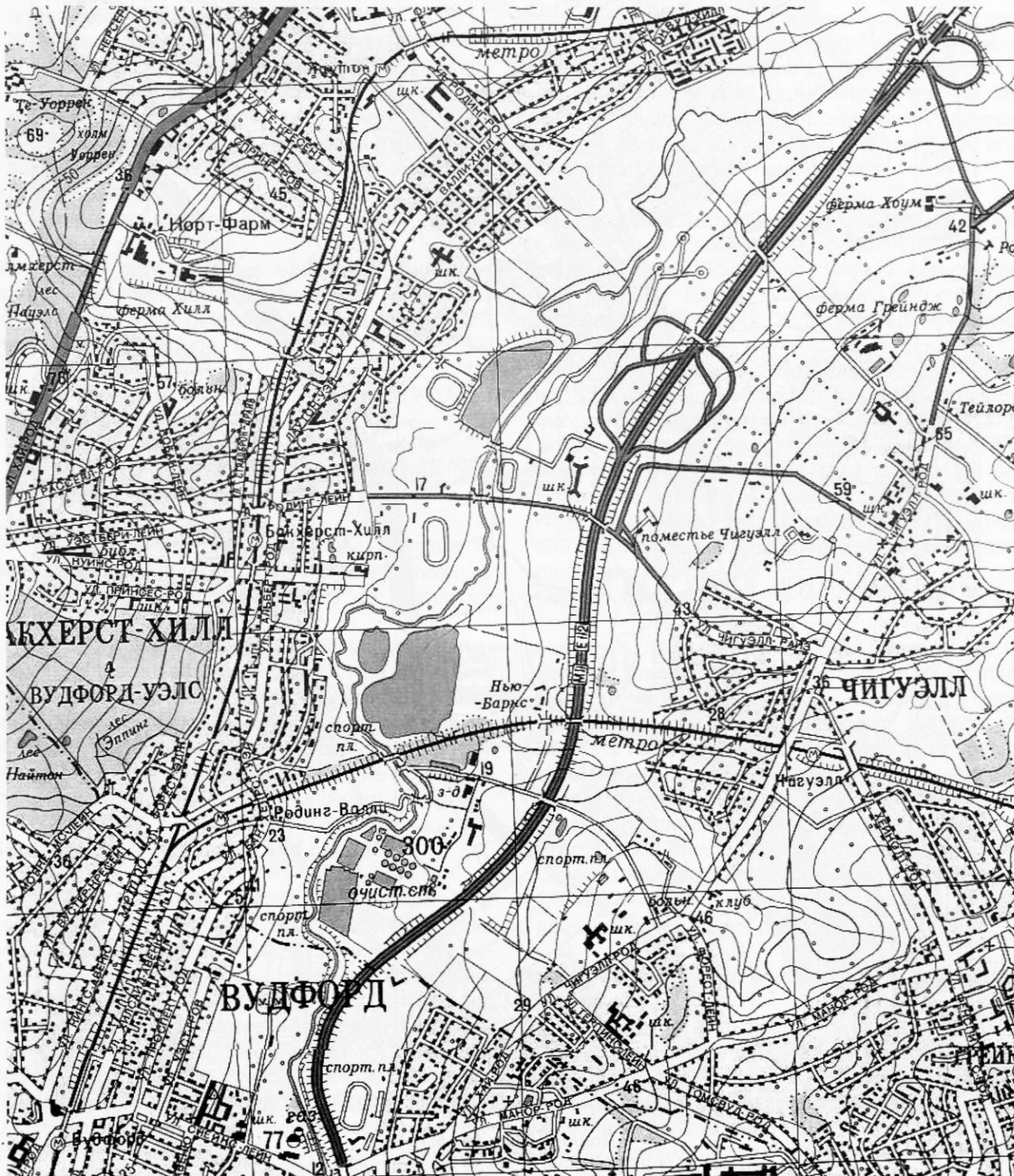
The railway lines, stations, sidings and ferry connections shown on the Soviet maps are generally considerably out of date. Old information appears to have been used and added to the aerial images, even

8. Thanks to CCS member Tony McCartan for spotting this.

9. For a list of European road numbers see <http://homepage.mac.com/longueville/lijste.html>.



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Roding Valley and M11

4: From London (east sheet) 1:25,000 scale compiled 1979 5: (Over Page) As shown on OS (1:25,000 sheet TQ49/59 revised 1983, published 1985)

Note the area where the B170 (Roding Lane) crosses the motorway. The Soviet map shows motorway works area just to the north and a lake to its west which do not appear on OS maps until later editions. The three 'running tracks' on the Soviet map are symbolic for sports fields. The Central Line tube stations are marked with M symbol (shown as 'Sta' on OS) and the M11 is named also E112. Spot heights 17 (by B170) and 19 (SW of railway/motorway crossing) are on both maps, derived from earlier six-inch 'County series' map.



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Roding Valley and M11

As shown on OS (1:25,000 sheet TQ49/59 revised 1983, published 1985)

where the line would no longer have existed at the time (although it may be that track bed, for example, would have been visible). As far as can be judged, the information seems to correspond to the old 'County' series six-inch OS maps of the 1920s, although some updating has occurred. Signals are shown at frequent intervals along lines, as shown on the old maps, although many of these would have been dismantled by the 1970s. Some examples to illustrate this:

- Blackpool (1976): railway network north from Poulton-le-Fylde serving chemical works north of Stanah, including two jetties in River Wyre, all shown as old OS, not on contemporary OS. Wardleys ferry across River Wyre also shown as old OS; conversely, the line running east from South Shore is shown on current (1971) OS but shown as disused on Soviet map.
- Oxford (1973): ferries SW of New Marston, and at



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Kennington and North Hinksey are as old OS and are not shown on recent maps.

- Newcastle sheet (compiled 1974, printed 1977) shows six ferries across the Tyne between the city and Tynemouth, of which only one (Shields ferry) is on contemporary OS maps.
- Glasgow sheet (compiled 1975, printed 1981) has six ferries over the Clyde between the city and Erskine Bridge of which only three appear on contemporary OS maps.

Many maps have instances of railways shown as normal lines which are shown as disused, dismantled or 'freight line, siding or tramway' on contemporary OS maps. Examples include

- Bristol sheet (compiled 1971, printed 1972): Avon Gorge and Mangotsfield lines.
- Glasgow: line running south west from Neilston.
- Chester (compiled 1972, printed 1973): Northgate terminus and Hawarden airport curve.

On the Manchester sheet, the area adjacent to Dairyhouse Farm (near Dunham Massey) is shown as having railway sidings, but this is blank on contemporary OS maps.

There is a symbol in the specifications for 'electrified passenger line' but this rarely occurs on the maps. One map where it does appear is the Chatham, Gillingham and Rochester sheet. This sheet has other instances of additional annotation (e.g. clearance on Medway bridges) which suggests it had special attention due to the proximity of the Royal Naval Dockyard.

Spot heights, bench marks and contours

There is considerable consistency between the positions and values of spot heights and benchmarks on the Soviet maps and those shown on the old six-inch OS County series. Many of these are omitted from the later National Grid series six-inch sheets and others have changed values due to re-levelling etc. The height values are converted to metric to one decimal place and the contour lines appear to be interpolated from these, mostly at 2.5 metre intervals. Oddly, the Cambridge sheet contains heights from two different editions of the OS six-inch maps. Some of the values are taken from the 1903 edition, others from the edition published in 1924, after re-levelling. This can be seen in two adjacent spot heights near Grantchester.

Place names

The study was confined to district names within urban areas, as these can most easily be traced back to a source, due to the positioning of the name and, indeed,

the choice of the names themselves. The general conclusion is that place names are for the most part derived from combining information from all available commercial street atlases and town plans. However a number of cases are found where the names appearing on the Soviet maps may be in common currency locally, but do not appear on any contemporary published maps or plans.

Some interesting examples :

- Blackpool: the following names are shown on the Soviet map and appear on Geographia but not OS maps: Holmes, Whiteholme, Grange Park Estate and Mereside Estate. Conversely, Anchorholme appears on all scales of OS but is not on the Soviet map.
- Cambridge: Red Cross, Haverfield, Kings Hedges and Douglas House all appear as district names on the Soviet map but not on OS, Geographia or A-Z. Soviet map has Brooklands (suburb east of city); this is named as Brooklands on 1983 Geographia but Brookfields on OS, A-Z and 1987 Geographia. Newtown is located near to Fen Causeway on Soviet and Geographia maps, but near to Botanic Gardens on OS and A-Z.
- Oxford: Barton Estate and Sunnymead Estate appear as district names on Soviet plans but are not named on OS or any of Geographia, Geographers or Barnett's maps. Sandyhill is named on Soviet map; this is Sandyhills on OS, Geographia and Geographers and Sandyhill Estate on Barnett's. St Ebbe's is named on Soviet map, this is a commonly-used name locally but does not appear on any map except Barnett's and old six-inch OS.
- Teesside map (compiled 1973, printed 1975) has Preston upon Tees, Eaglescliffe Junction and Acklam Garden City. Former appears as Preston-on-Tees on OS and street plans; other two do not seem to exist as place names on any published map (so far seen).

Annotated details e.g. widths, heights, clearance, surfaces etc

Some maps have annotation giving the widths of roads, rivers and canals; the length and width of bridges and tunnels; construction material for bridges and surface material for roads. This information is generally sparse, but where it does appear there is often an abundance in the same locality. This could imply that special exercises were undertaken in certain cases, but there is no obvious reason why this should be so.

For example, the Edinburgh map has about twenty instances of road widths, mostly on the eastern fringes of the city; Blackpool has five in two localities; most maps have none. In a few cases, road surfaces are indicated (usually asphalt).

As noted earlier, the Chatham, Gillingham and



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Rochester map has the dimensions and height of the two Medway bridges shown. They are also indicated as being of reinforced concrete. The Thurrock map shows the dimensions of the Dartford Tunnel, whilst the Liverpool map has the width of the Leeds and Liverpool canal annotated as '18 metres' in three places; presumably this is a mistake (possibly 18 feet?).

The curious case of the Reserves: The Oxford map has the words reserve or preserve in Cyrillic text at Old Boars Hill to the south west of the city, in similar sized typeface to important place names. The land here is marked on larger scale OS maps as belonging to the Oxford Preservation Trust. The Liverpool sheet has 'Reserve Speke' at Speke Hall (National Trust property) and the Manchester and Huddersfield sheets have 'Reserve' on National Trust land at Marsden Moor in the Pennines.

It is not obvious why this was considered useful information, unless the Russian term implies land reserved for military use.

Hydrographic information

Submarine depths and underwater obstructions cannot be seen from the air and they cannot be discovered by picnicking diplomats, so it is natural to suppose that they must have been taken from Admiralty charts. However, apart from three specific cases, there is hardly any similarity between the information depicted on the Soviet maps and the respective Admiralty charts.

The three cases of close similarity are a short stretch of the River Medway (Figs. 6, 8), Granton Harbour (Edinburgh) and Dover Harbour. All the other areas examined (fifteen harbours and estuaries round the British and Irish coasts), simply do not correspond.

It has been suggested that the marine data is taken from captured German WWII charts. If so, it has been updated, as many navigation channels have the legend 'Dredged to xx metres (19yy)' where yy is a recent (60s, 70s) year.

Proposed roads, etc

Roads under construction, such as the Edinburgh southern by-pass and sections of M62 and M66 are shown as such, even when not shown on contemporary OS maps. Presumably they could be observed from the air or derived from other road atlases etc.

However, one road is shown in dotted lines (indicating either proposed or under construction) that was never built and does not appear on any map or atlas so far seen. This is on the Teesside map, running SW from old A19 (now A135) south of Stockton, crossing the Tees at grid reference 437155 to join A1045 south of

Thornaby. The source of this information is not known.

Index of 'strategic objects'

All the maps have selected 'strategic objects' identified, colour coded (black for industrial plants, purple for administrative premises and green for items of military significance) and indexed.

The Chatham, Gillingham and Rochester sheet has 70 such, including 22 factories, 8 transport facilities, 6 barracks / military schools, 15 depots / utility plants, 6 post offices, 2 police stations and various buildings such as airfield, broadcasting studio, customs house, town hall. The Dublin map has 63, including airfield, prison, Ordnance Survey office, Observatory, Court, Bank of Ireland, 20 factories, 9 barracks, 13 port, bus or train depots / stations and 7 colleges.

Most of the industrial premises have the product identified and many have the companies or proprietors named.

Some strange anomalies are found, however. The airfield marked on the Dublin map is in fact the racecourse in Phoenix Park and there is no evidence on any published map that this was ever used for aircraft. Similar unlikely airfields appear on the Liverpool map (the reclamation ponds by the river at New Ferry) and the Blackpool map (the Royal Lancashire Showground). The Cambridge map has the residential housing development at Harvey Court identified as the law courts, presumably due to misinterpretation of the name. Strangely, the Dublin map does not identify Leinster House, seat of the Irish Parliament.

These lists would appear to be compiled from a combination of sources such as trade directories, street plans, various reference books and, probably, visual investigations.

Descriptive text

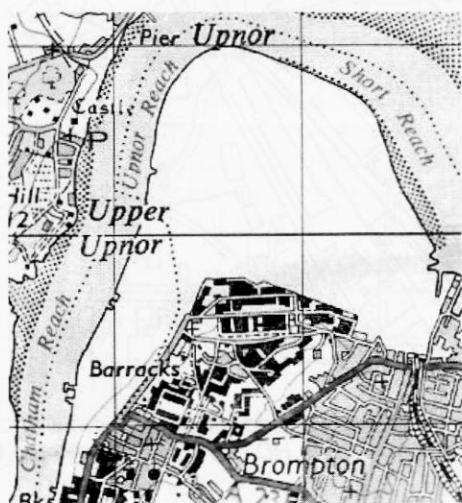
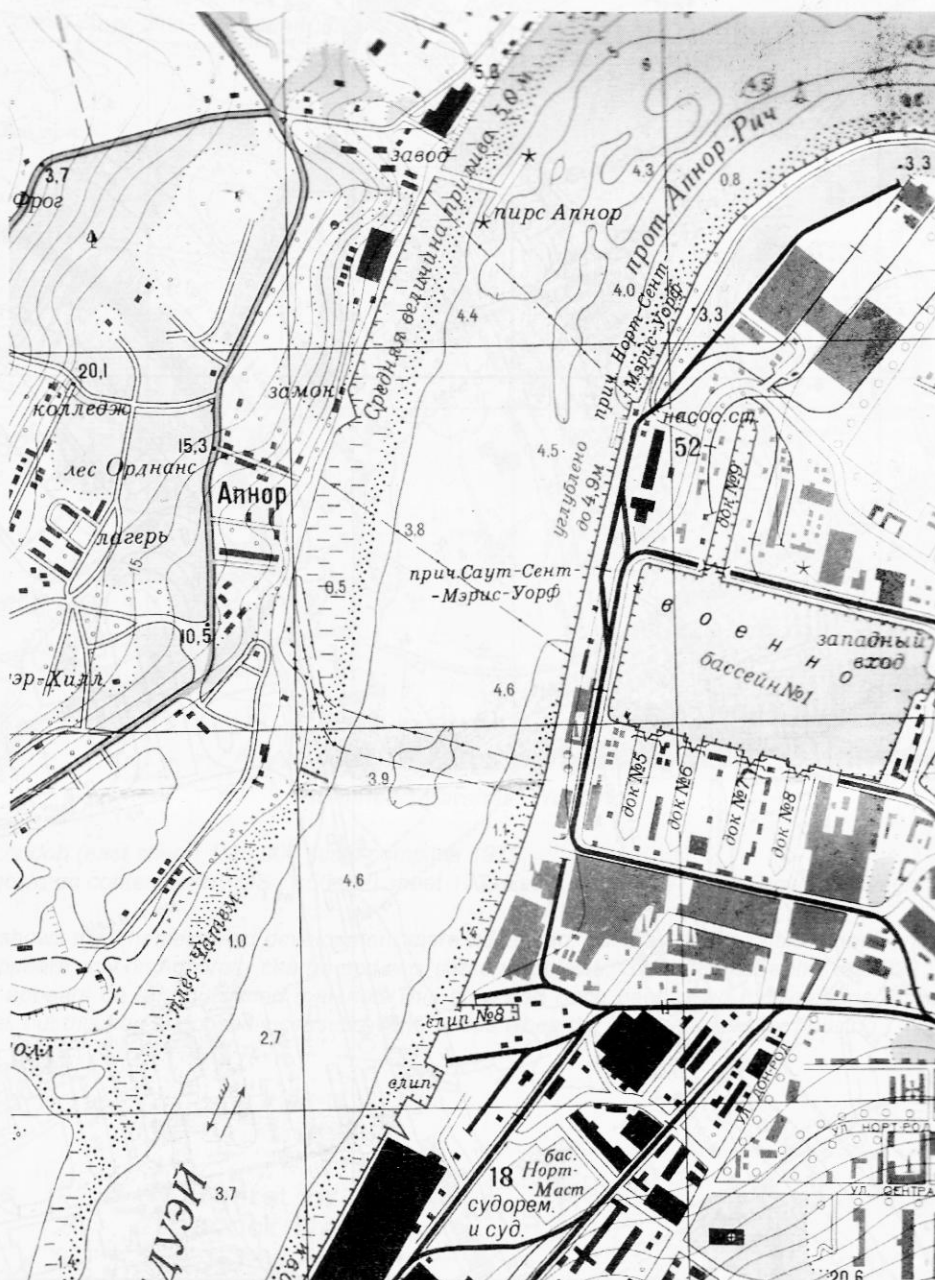
Another impressive feature of the maps is the Description of the Locality. Typically, this runs to about 1500 - 2000 words, with considerable detail about the population, topography, climatic conditions, vegetation, communications, housing types, districts and layout of the city, utilities, industrial production, 'communal enterprises and sanitation facilities' and so on. The text for Birmingham includes the observation 'railroad tunnels may be used for cover [with locations and lengths] and also many working and abandoned coal mines and quarries'.

The source of the information is likely to be the same as for the Strategic Objects, above.



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Chatham Royal Naval Dockyard and River Medway

6 (above): from Chatham, Gillingham & Rochester, 1:10,000 scale, 1982.
 7 (left): from one inch sheet 172, 1964, © Crown Copyright NC/00/1340.
 8 (next page): from Admiralty Chart 1835 River Medway, 1:6000 scale, 1977.

This short stretch of the Medway is one of the very few places where the Soviet maps correspond to the respective Admiralty chart. In this case, the spot depths, the bathymetric contours and the submarine cables are similar, as is the annotation 'Dredged to 4.9 metres' and the names South St Mary's Wharf and Upnor Jetty. The buildings and railways, however, are quite different. In the stretch of river immediately east of here – as in practically the entire country – the hydrography on the Soviet maps differs from Admiralty charts. In the 1960s the OS maps blanked out the dockyard, but the detail did appear in later sheets.



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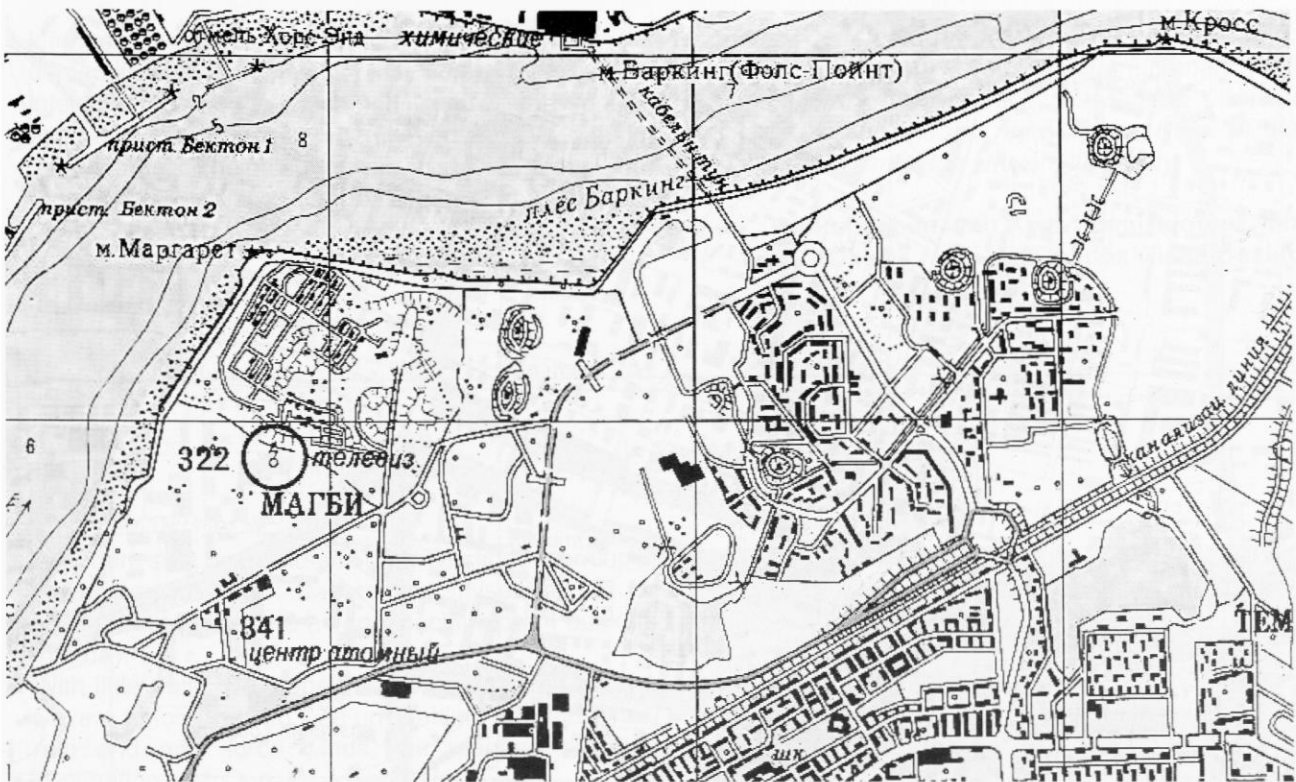
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Uncle Joe knew where you lived The story of Soviet mapping of Britain (part II)

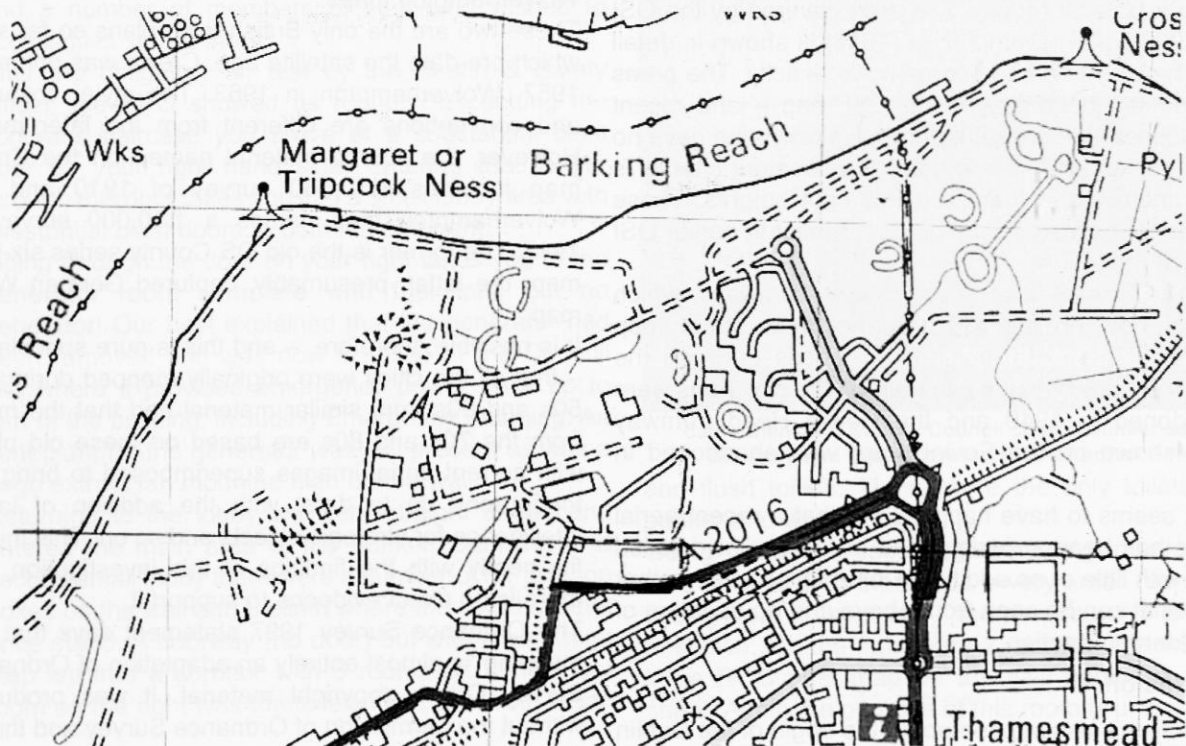


Plumstead Marshes, Woolwich

9 (above): from London (east sheet) 1:25,000 scale compiled 1979.

10 (below): as shown on contemporary OS (1:50,000 sheet 177, East London, 1978), © Crown Copyright NC/00/1340.

The Soviet map shows the Thamesmead development more advanced, but also has a 'cable tunnel' under the Thames to Barking (which appears only on Admiralty charts) and two 'strategic objects', 341 'Atomic Centre' and 322 'Television tower'. Neither of these appears on any published material. This area had once been used for weapons testing by the nearby Woolwich Arsenal, but this had supposedly ceased by the 1960s when the land was sold for housing.



Uncle Joe knew where you lived The story of Soviet mapping of Britain (part II)

infringes Ordnance Survey's Crown copyright'. As demonstrated above, it is not that simple. As far as the later town plans are concerned, most of the content has been sourced independently and any OS material that was used (heights and railways) was already out of copyright (and potentially out of date) at the time.

I am very grateful to the following for valuable advice and information: Paul Ferguson, Map Librarian, Trinity College Library, Dublin; Nick Millea, Map Librarian, Bodleian Library, Oxford; Anne Taylor, Head of Map Department, Cambridge University Library.

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A Day in Wales

A 4.50am start on a cold and dark Thursday morning in November, saw Nick Catford and myself set off for South West Wales and a very special trip – 4 bunkers in a day.

With little traffic we made good progress crossing the Severn before the sun was up. Battling through heavy rain and gale force winds, we reached our first destination – McDonalds for breakfast!!

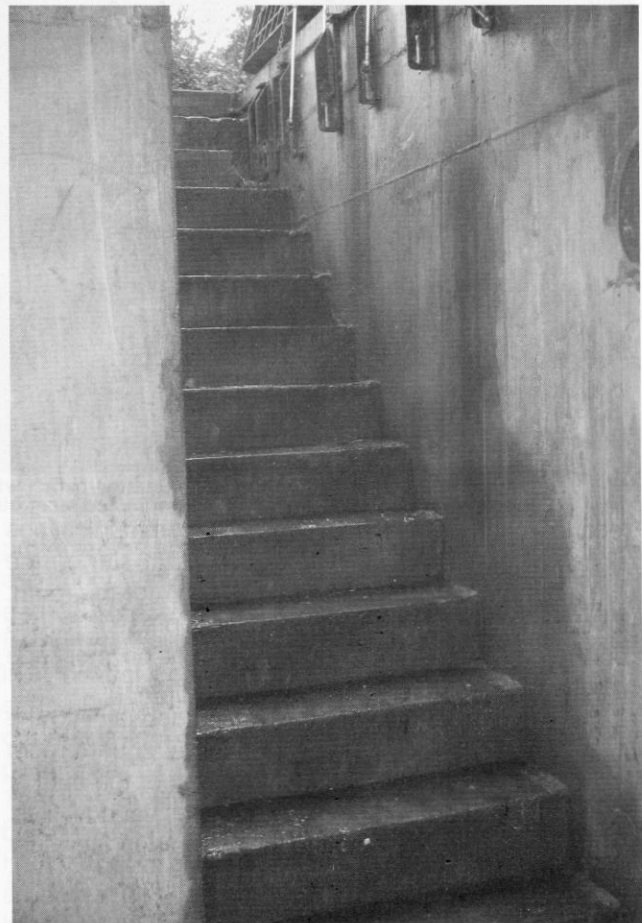
Suitably refreshed, we drove the last few miles to Camarthen where we had arranged access to the former Camarthenshire County Council control bunker, located under a car park in the town centre.

Arriving early we located the entrance which is under a set of very large and heavy access covers towards the rear of the car park. After a few minutes workmen from the council arrived to open the bunker for ourselves and a number of members of staff who wished to access files stored there.

After the obligatory air test by the Health & Safety officer, the EPO showed us round. Descending the concrete staircase you arrive at a substantial blast door on your right hand side. Entering the bunker through this door takes you into a small lobby area with substantial blast doors to both left and right.

Going through the door on your right takes you to the generator room complete with fuel tank but no generator! Our host explained that the generator had been removed and was now installed at the Council HQ where it provided emergency power back up to part of the building, including Emergency Planning. Air vent plant for the generator was still present as was a large extract fan mounted high on the wall.

Returning to the lobby we went straight ahead and entered the main area of the bunker. Standing in a second small lobby there were a number of BT junction boxes on the wall and a plinth where the SX50 cabinet once stood. A doorway (no door) but with a very high step led into a corridor with 5 rooms off it. The first room on the right was the toilets fitted with both Elsan

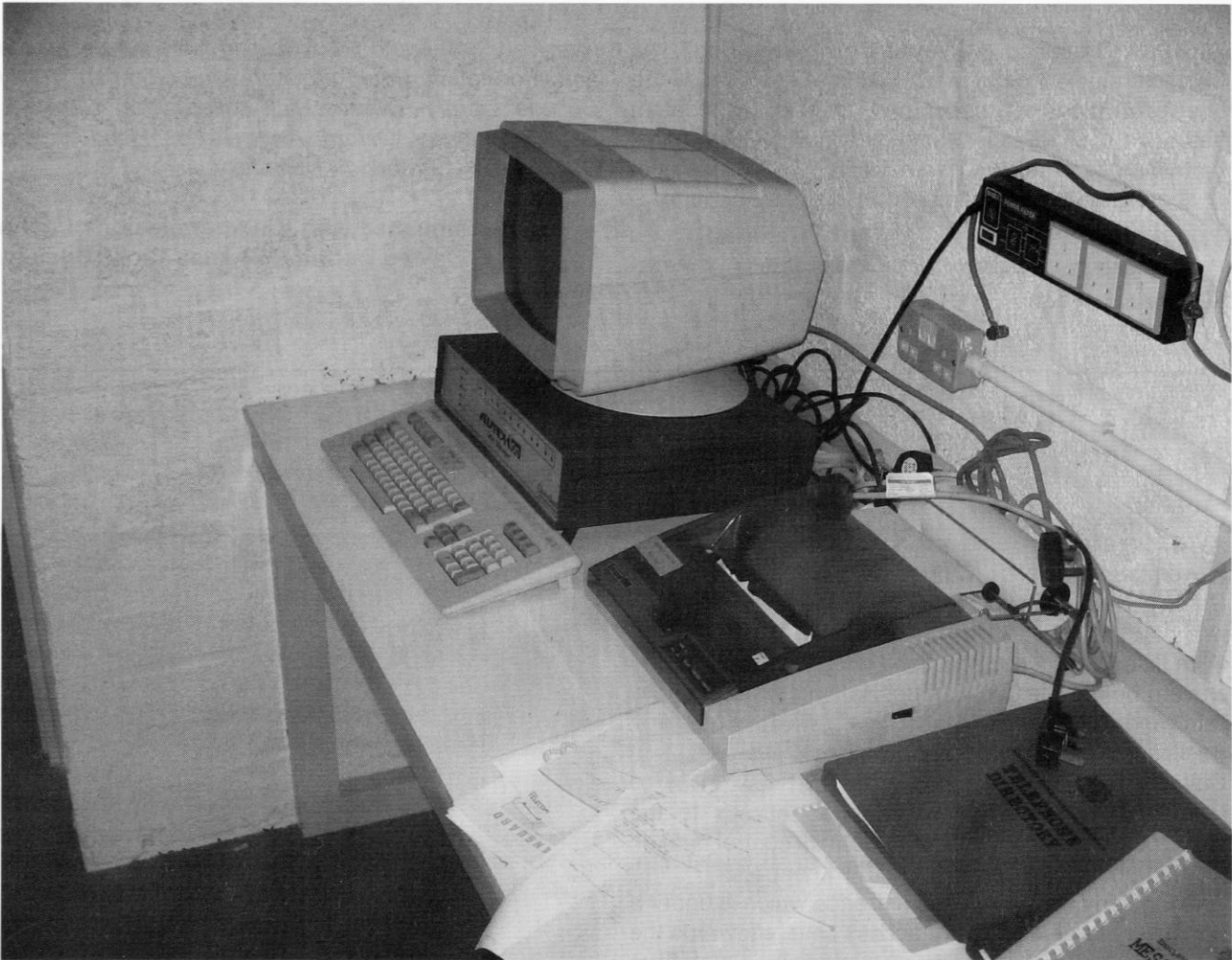


**Camarthenshire County Council control bunker access
Stairway and heavy covers - Photo Andrew Smith**

and flush toilets. These were the only toilets in the bunker and were unisex.

Going through a second doorway again with a high step and no door there was a very small room with a sliding door on your left – the purpose of this room is unknown. On the right were 2 rooms – the first had a large ROC post map on the wall behind a perspex sheet. Again the purpose of this room is unknown. The

A Day in Wales



Autex 100 unit in situ on the wall mounted bench which ran the length of the room. - Photo Andrew Smith

second room on the right was the communications room which still had an Autex 100 unit in situ on the wall mounted bench which ran the length of the room. Various BT junction boxes were also present in this room along with a variety of paperwork on message handling and a few old manuals.

At the very end of the corridor was a doorway into the main operations room. This was a large, square room approximately 25ft by 25ft. Like the rest of the bunker it was full of cardboard boxes holding various files. Large scale maps for both the local area and the wider South West Wales region were still in place on the walls, again covered by perspex sheeting.

Everything else had been removed from this room (and for that matter, the rest of the bunker) but there was a doorway that led to an air filtration room and then on to the vertical emergency escape shaft, which opened out into another access cover, on the other side of the car park.

Having documented everything and taken photographs, we gave thanks to our host and set off for the Camarthen ROC bunker, perched high on a hill over looking the town.

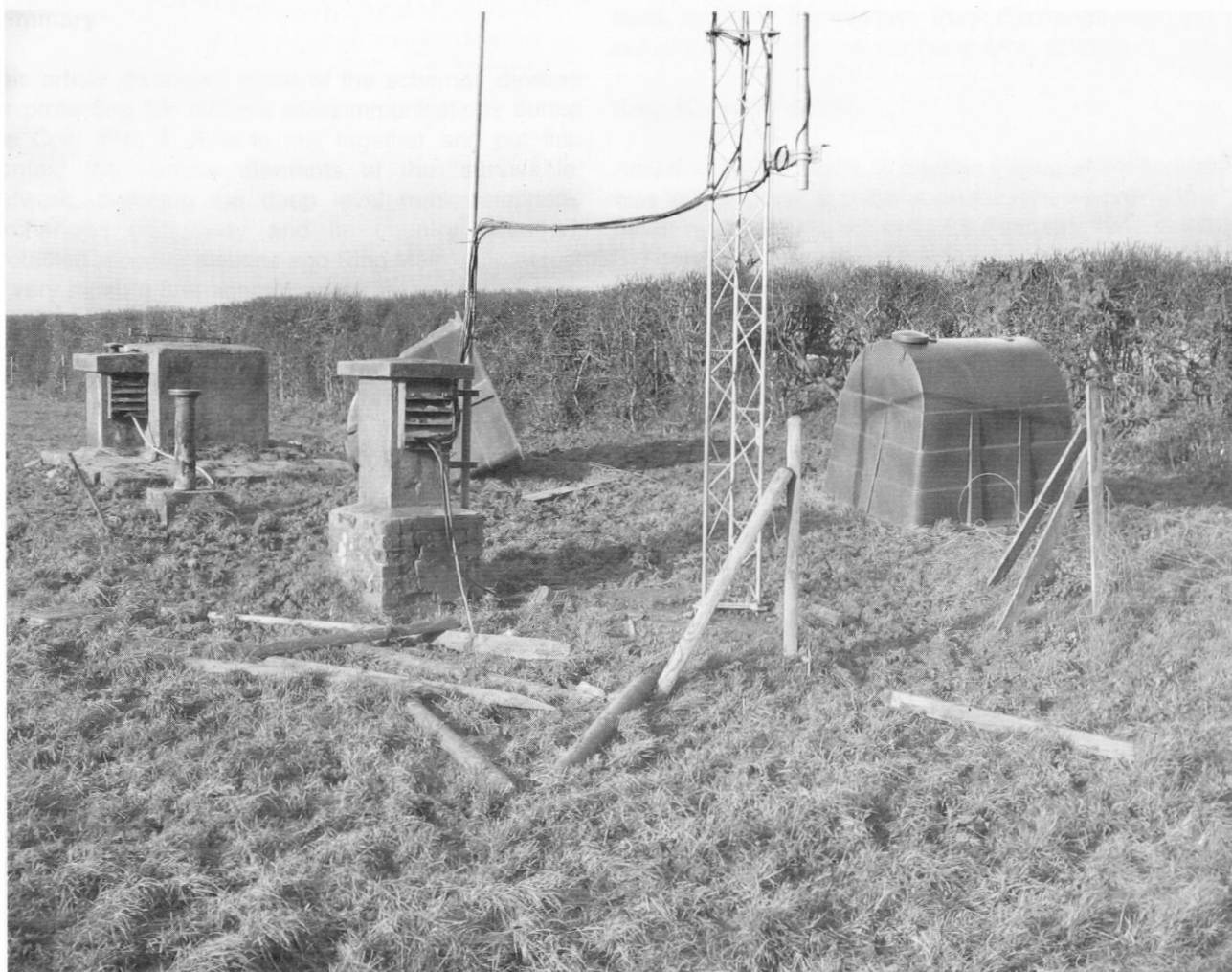
Driving up a very narrow track, we parked the car and walked the last 300m across a very muddy field full of sheep. The bunker is now in use as a radio mast base for local taxis etc. Alongside is a separate, fenced site for Crown Castle Communications containing 2 substantial mast with mobile phone antennas and a variety of other radio relays. Having taken a couple of pictures we walked back to the car accompanied by several sheep and the farmers Collie dog who took a strange liking to me.

All that walking had made us hungry, so we stopped in the village of Narbeth and enjoyed a local hostelry which did a fine lunch and quality real ale, on our way to the next site.

It wasn't far to the Narbeth ROC post which is owned by the same person who owns the ROC post at Camarthen. This was in a sheltered position and much better condition. Again, there was a radio relay mast for the use of local taxis etc. The ROC post itself has an unusually large vent shaft. A metal done on the side of this indicated it was a master post.

The owner has fixed a home made camera to the post which was pointing North which we later discovered

A Day in Wales



Camarthen ROC Post -The bunker is now in use as a radio mast base for local taxis etc.- Photo Andrew Smith

was for monitoring the works in an adjacent field where Transco were installing a major gas pipe across open countryside.

Like the Camarthen ROC bunker this was securely locked so having taken a couple of photographs, we set off for our final destination a few miles further on – the Uniter bunker at Templeton airfield.

Like many Uniter sites, this bunker was up for sale and we managed to co-ordinate our visit with the final open day for public viewing, prior to the bunker being auctioned off.

We weren't alone with a total of around 25 people waiting to view. After a long wait in the cold and rain the person with the keys finally turned up and we could explore.

Set in a fenced, secure compound on the southern edge of the former airfield, the bunker was in excellent condition with no vandalism.

Defence Estates had decided to dispose of this site along with a near identical bunker at Goole. Now disused and without power, we were given free run of the site and made the most of it.

Entering the bunker through a heavy duty blast door,

protected by an external blast wall, you are standing in a corridor. Going right takes you past the single toilet and a corridor into the plant room on your left, to the former workshop area. In here was the main power inlet control board and steps to go up into the roof space to access the vent area. Re-tracing our steps out of this room we turned right and entered the main plant area.

This was totally intact apart from the air compressors being missing. All air handling plant, pumps, heaters, HV/LV control gear etc was in tact and unmarked. This area was dry and the equipment still had service log books in places. On the right hand wall behind the air handling plant was a large size schematic drawing of the plant equipment. To the right of the plant room were double doors into the generator room. In here was a small fuel header tank and the beautiful cream coloured generator, complete with starter batteries connected. Everything was in place and there was the faint smell of Diesel in the air. Much of the plant had 1991 or 1992 date plates attached to it.

Walking back through the plant area we came to a door that led to a small entrance vestibule at the rear



A Day in Wales



The Uniter bunker at Templeton airfield - Photo Andrew Smith.

entrance of the building. A second door led off this Vestibule into the main communications room.

This is the main room in the bunker and looking at the rack marks and holes cut in the suspended floor, was at some stage kitted out and operational. Lifting some of the floor tiles we discovered large amounts of condensation and small pools of water (the sump pumps had been switched off long ago). Under the floor were substantial quantities of cables confirming our initial thoughts that the building had been active at some stage.

A small room off this area housed the fire suppression system, complete with connection points for now removed Halon bottles. This small room also doubled as a stores area and there was a section of dexion racking with everything from lightbulbs and fuses to sticky tape and a first aid kit in-situ.

Walking through the main communications room toward the main entrance, we came to the fire control panels. These were all in tact and whilst the power was switched off, appeared in serviceable condition (as was just about everything else in the bunker).

Next to the fire control panels was a set of double doors leading into a power room. This room housed a substantial UPS unit, racking for a large number of back up batteries and further high voltage power

switching gear. Returning to the communications room we then exited via a secure door into a short corridor. Off this corridor were 3 rooms.

The first was the cable inlet room. Protected by a secure door with double combination lock, this room is where cables from outside entered the building. There was a small amount of water on the floor in this area.

The next room appeared to be an administration office with a number of telephone points on the walls. Directly opposite this room was another small store room, with numerous spare parts residing on shelves. Walking further along the corridor and turning left brought us back to the main entrance – we had completed a circular route around the bunker.

Outside, the compound is a little overgrown and the buried fuel tank has been filled with expanding foam. The fence was intact and there was no vandalism anywhere. The bunker was sold at auction in December 2006.

As the rain lashed down we got back in the car and set off for the 200 mile drive back to London, arriving home totally exhausted, some 15 hours after we had left. What a splendid way to spend a day.

From Andrew Smith



Communications in context: plans for protection

Summary

This article discusses some of the schemes devised for protecting the nation's telecommunications during the Cold War. It aims to pull together and put into context the various elements of the 'survivable' network, including the deep level trunk telephone exchanges (Kingsway and its country cousins), protected repeater stations and Ring Main schemes. It is very much a first attempt and does not claim to be an exhaustive survey, simply because official records are either unavailable or remain to be discovered. All the sources used are in the public domain.

Flashback to 1939

Planning for the Cold War was inevitably based on the experience of World War II and it is here we must look to understand what came later. A key element of the protection of telecommunications during that war was schemes to route important cables to bypass cities seen as targets for heavy bombing.

These were called 'ring main' schemes by analogy to the ring mains used in electric power wiring that allow current to continue flowing even if the ring is severed. The first mention I have discovered is Document HO 186/26 at the National Archives, entitled Position of War Rooms at 13th July 1939. Because it explains the system so clearly, it is worth quoting in full:

London Ring Exchanges (short term)

Under this scheme ten exchanges (originally 8 but 2 were added later) on the periphery of London are being extended and will function as tandem exchanges on trunk calls to and from London subscribers. They will be put into use only if Faraday Building is put out of action.

A ring main cable is being provided between Shepherds Bush and Colindale as an advance position of the long-term scheme for decentralising trunks. This will enable circuits from the north and north-east to be linked to the north-west, west and south-west routes. It will also provide routes for defence service private wires independently of Faraday Building. For completion by November 1939.

Provincial cities

The 12-channel carrier trunk telephone cables planned for the next few years in the neighbourhood of Birmingham are being laid around a ring main duct route instead of through the centre of the city.

Repeater stations on the ring main are being sited so that manual switchboards can be provided in convenient buildings nearby and extending circuits on physical pairs to the centre of the city to provide some

trunk service if Birmingham Trunk Exchange were put out of action. This is a very long-term scheme.

Ring Mains in detail

Actual implementation of London's Ring Main system was fairly modest (the Birmingham scheme seemingly never went ahead). An entry for February 1941 in the London Telecommunications Region War Diary (at the BT Archive) states: "Arrangements are in hand for the speedy establishment of 'Ring Centre' offices at Acton, Addiscombe, Finchley and Stratford." Seemingly, Addiscombe came into use on 19th May, and looks to have been the second centre to have opened. These were manual switchboard centres for handling trunk calls

London's Ring Main system was complemented by a system of radial cables connecting important exchanges in central London with the Ring Main, so that interruption by bomb damage to any of the radial cable routes could be restored readily by suitable re-routing of the circuits over the Ring Main cables at the interception centres (the so-called Ring Main exchanges). The radial scheme was started in the late autumn of 1940 and completed during the following year, involved the laying of 250 miles of cable of which 116 miles were in public tube railway tunnels, another 20 miles in the Post Office Railway and a short but vital section in the 12ft diameter pilot tunnel under the Thames at Dartford, constructed before the war in advance of the main road tunnel.

In addition a large repeater station for trunk cable routes was built next to the North Circular Road, aimed at linking arterial trunk routes without the need to head to or radiate from the centre of London. Known first as the Hendon Ring Main exchange or Hendon Sub-Trunk Centre, then later as the Brent Building, this was opened for telegraph circuits in October 1944 and for telephony in February 1945. It was strategically important enough to escape the ban on new building construction and stood on the north side of the North Circular Road. Plans of the early 1950s allocated it a key role in the hardened national trunk telephone system (see later) but it was later put to other uses and was demolished to make way for the Brent Cross shopping centre.

Brent Building appears to be the only Ring Main repeater station actually built. A comparable structure, known as Wheatstone Building, was built in 1953 at a spot near Kew Bridge, between what became the Chiswick Flyover and Brentford Market. There is speculation that it was intended as a Ring Main repeater station and that the necessity for it had passed by the time it was complete. In the event it became a major telegraph and transmission centre and was still a key network node when in the late 1980s. One might reasonably imagine that similar



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centres had been planned for places such as Kingston-upon-Thames, Croydon, Bromley, Ilford and Tottenham but there is no firm evidence.

Ring Main 2

A second and more radical solution was adopted towards the end of 1943, when the possibility of heavy attacks on the London area was considered to justify additional measures to

safeguard communications between London and other parts of the country. A scheme also known colloquially as the 'London Ring Main' but more correctly described as an outer ring main was provided to interconnect repeater stations ringed about London at a radius of some 30-40 miles, using the latest design of multi-channel radiotelephone equipment. Using mobile equipment, selected repeater stations on different cable routes radiating from London could be linked quickly so as to divert circuits to alternative routes.

Cold War continuation

The peace that followed the end of World War II was brief. In 1948 planning began in earnest for World War Three, and by December 1949 a comprehensive plan had been conceived for protecting strategic communications. At the centre of this scheme was an atomic bomb-proof underground telephone exchange (named Kingsway) in the centre of London, linked to a network of deep-level cable tunnels. This well-known facility was to be matched by less well-known smaller replicas in provincial cities.

It was in December 1949 that a Treasury paper entitled United Kingdom Telecommunications in War recommended some £2.75 million be spent over five to six years on a scheme for strengthening the telecomms facilities needed for defending the country.



The Brent Building - Photo Anon

Mitigating this enormous level of expenditure was the fact that part at least of the infrastructure to be created would have wider user in peacetime (such as Kingsway trunk switching telephone exchange) and that were it not constructed underground, an above-ground building of comparable cost would have been needed anyway.

The anticipated costs grew rapidly, however. A top secret (now declassified) memorandum (or 'minute' in civil service language) dated 10th March 1950 provided clarification of the scheme's contents embracing three categories of construction:

- (1) works in an around London providing protected telecommunications and alternative routes, to cost £4 million spread over four years;
- (2) similar works in provincial cities not yet fully formulated or agreed, costing up to £10 million;
- (3) 'concealment' works not really for the Post Office but carried out under the cover of that body's works, e.g. the provision of underground war rooms. "These proposals, likewise, are not fully formulated and we will certainly not get much in the way of detail for some time," added the writer.

That same day the Post Office representatives at a joint meeting with the Treasury made it clear that the capital investment allowed to the Post Office for normal development left no residue for the cost of these



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defence schemes. The Treasury insisted the contrary, pointing out precedents had been set in 1926 for the construction of Rugby radio station and during the war on the spurs leading off the Whitehall tunnels. Moreover, the government was 'anxious to avoid public notice being drawn to the fact that substantial expenditure was being incurred on civil defence measures'. In the event the Post Office budget was increased to cover the cost of its Category I civil defence measures.

Detailed plans emerge

By October 1952 comprehensive plans had been made for the Post Office defence programme, as a top secret (also now declassified) draft report to the Defence (Transition) Committee made clear. But although the report itself recommended that a number of schemes originally planned be now excluded, even the works described as proceeding did not all reach fruition. The phrase used, 'deferred in favour of ROTOR' (the national air defence radar system) says it all, as we shall see again shortly.

Schemes described as proceeding were:

- London zone trunk exchange, Kingsway.
- Deep level cable tubes connecting the central telecommunications centres of London with one outlet in north west London [Brent Building]: Holborn – Whitehall; Holborn – Museum; Faraday – Waterloo; Waterloo – Whitehall; Museum – Cunningham; Cunningham – Colindale.
- Dispersal of transmission equipment along cable routes to telephone exchanges in the London area.
- London carrier ring main—a ring cable at about 30 to 60 miles radius to enable main trunk telecommunications to bypass London.
- Birmingham zone centre and cable tubes.
- Birmingham ring main—protected installations of transmission equipment on about a 5-mile radius with interconnected cabling to enable permanently through communications to bypass the city centre.
- Manchester zone centre and cable tubes.
- Manchester ring main—as for Birmingham.
- Glasgow ring main—as for Birmingham.
- Bristol ring main—as for Birmingham.
- Leeds ring main—as for Birmingham.
- Liverpool ring main—as for Birmingham.
- Chester zone scheme—to relieve Liverpool of all through switched traffic, leaving Liverpool with terminal communications only.
- Nottingham zone scheme—protected central installation of transmission and automatic switching equipment for trunk telephone service to the Nottingham zone.
- Derby ring main—as for Birmingham.

- Swansea zone trunk scheme—as for Nottingham.
- Outhousing of the London terminal of Cable & Wireless.

Schemes described as excluded from proceeding were:

- London 'Pirate'—deep level installation to protect Defence Services telephone and telegraph private wires plus mechanised Federal exchange. Suspended by Cabinet decision.
- Leeds zone centre and cable tubes.
- Liverpool zone centre and cable tubes.
- Glasgow zone centre and cable tubes.
- Bristol zone trunk scheme—outhoused protected installation of automatic switching equipment for telephone service to and via the Bristol zone.
- Cardiff zone trunk scheme—as for Bristol.
- Belfast zone trunk scheme—as for Bristol.
- Plymouth zone trunk scheme—as for Bristol.
- Portsmouth zone trunk scheme—as for Bristol.
- Newcastle zone trunk scheme—as for Bristol.
- Sheffield zone trunk scheme—protected basement installation to safeguard telephone communication to and via the Sheffield zone.
- Coventry zone trunk scheme—as for Sheffield.
- Middlesbrough zone trunk scheme—as for Sheffield.
- Edinburgh zone trunk scheme—as for Sheffield.
- Leicester zone trunk scheme—as for Sheffield.
- Reading, Cambridge and Tunbridge Wells zone trunk scheme—as for Sheffield, listed as 'linked schemes'.
- Ring mains at provincial centres, deferred in favour of ROTOR.
- Swansea zone ring main.
- London cable tubes Waterloo–New Cross; P.O. Headquarters–Bishopsgate.

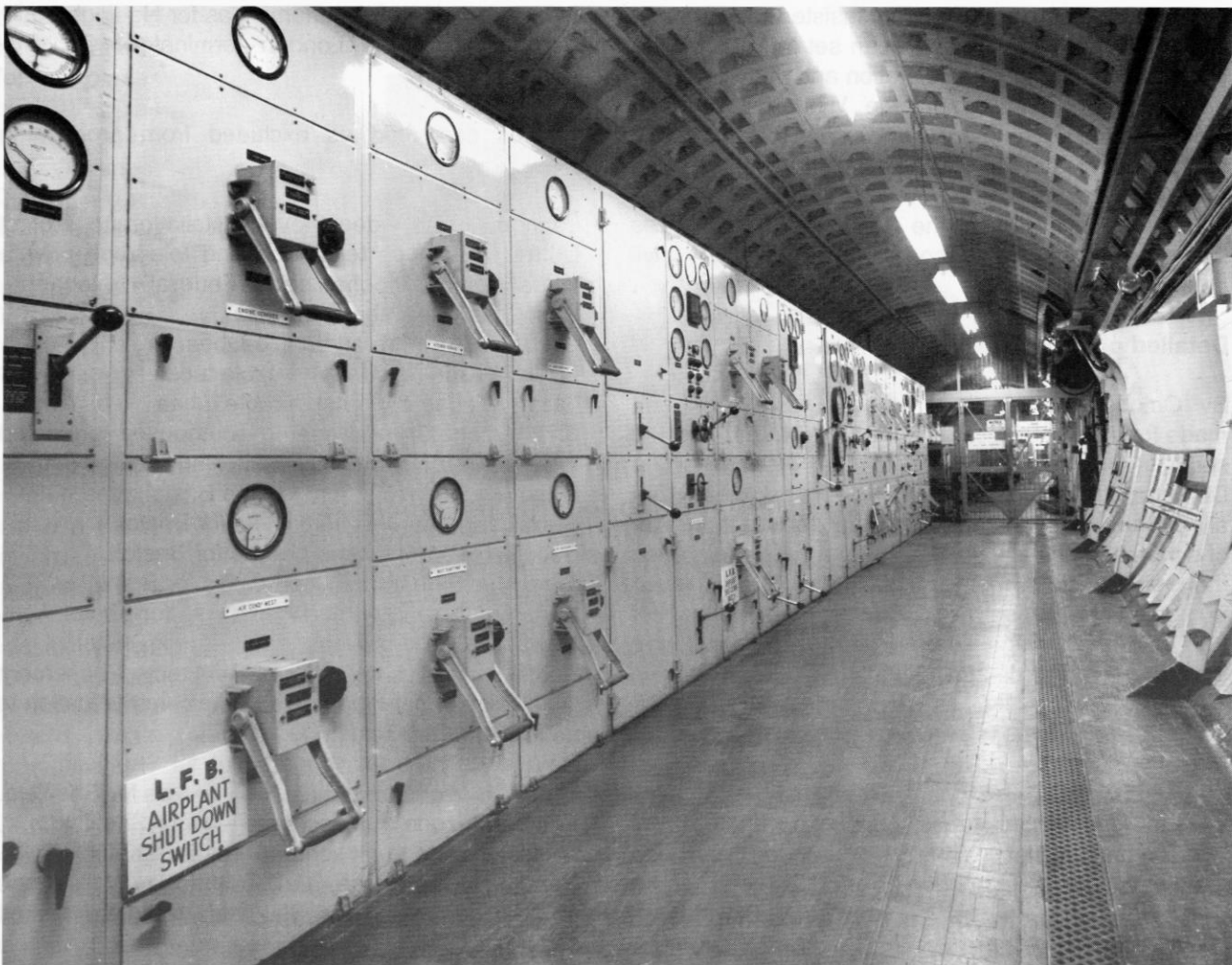
Some of these descriptions betray either a poor grasp of the works involved or a strange choice of terminology. Although not stated explicitly, the zone centre exchanges (termed 'centrals' in the report, perhaps by analogy with 'terminals') having also cable 'tubes' were to be located underground. A few of the schemes were revived later on a reduced scale in one form or another, whilst later on emergency manual switchboards were placed in protected basements built underneath most main telephone exchanges.

Cutbacks

It is notable too that even the schemes that went ahead were pared down to some degree. The approved scheme shown above envisaged the London cable tunnels reaching all the way out to Colindale exchange but in the event they never went further than Cunningham exchange in Maida Vale. Similarly the



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Air conditioning control equipment in the Kingsway deep level trunk exchange - Photo by Nick Catford

long tunnels planned to take cables from the underground exchanges in Birmingham and Manchester to safe locations outside the notional damage radius caused by direct hits by a single atomic bomb (London, it was envisaged, would attract a spread of four).

In both of the provincial cities, the vital cables from London came in along trunk roads from the south-east and left similarly to the north-west. A Ministry of Works file of 1951 at the National Archives indicates that in Birmingham's case the planned entry/exit points were Victoria exchange (south-east side) and Northern exchange (north-west). Likewise for Manchester, they were at Lime Grove/corner of Stockport Road (south-east) and Pendleton telephone exchange (north-west). Construction of the ring main schemes shown in the 1952 document appears to have been patchy, with hardened or 'protected' repeater stations erected with some installations. Birmingham had these built at Lyndon Green (south-east) and, to the north-west, at Queslett. Manchester has Ardwick and Stockport (south-east) and Swinton (north-west). Other PRS sites are Portsmouth, Warmley (Bristol, now

demolished), Rothwell Haigh (Leeds) and Uddingston (Glasgow).

The existence of these PRS locations may indicate that some progress was made at a later stage with the Ring Main schemes for Bristol, Leeds and Glasgow. It is known that an underground exchange was constructed later at Nottingham [Archer, built in a protected basement]. One is left to assume that the schemes for Liverpool, Chester, Derby and Swansea do not go ahead. On the other hand there has been much speculation that a system of deep level cable tunnels was nevertheless built in Glasgow and this is confirmed by a Building Research Establishment publication of 1974 called *Future Tunnelling in Britain*. It is described as a drift tunnel about 1 mile long and a BT employee described it as taking the form of a letter 'H', connecting Telephone House (Pitt Street, G2) with Dial House (Bishop Street, G3) and Douglas (Renfrew Street, G2) exchanges. It is stated that there is no deep level exchange in these tunnels. For completeness we can mention another telephone cable tunnel in a provincial capital; this is the one in Cardiff and like that in Glasgow, it has no real

Communications in context: plans for protection

connection with the Cold War. It was constructed during the late 1970s, with a diameter varying between 2.5 and 4.5 metres and a length of 1.4 kilometres (0.8 mile). It runs in the city centre from the west bank of the River Taff to Ruperra Street, by way of the Stadium House telephone exchange.

Kingsway's country cousins

By the time London's Kingsway protected telephone exchange was being completed in 1954, work was also beginning on similar deep level projects in Birmingham and Manchester. As indicated above, these were trunk telephone exchanges, intended for switching long distance calls only and having no subscriber connections. The original intention was to build not just three but six underground 'units of trunk service equipment'. London, Birmingham and Manchester are the sites that were actually built but others at Glasgow, Leeds and Liverpool were not, greater priority having been given to ROTOR intended to counter the Soviet threat.

Characterising these works was the level of secrecy surrounding their construction; today it seems extreme but in the Cold War climate of the day it was entirely understandable. Duncan Campbell states, "—the exchanges were built in complete secrecy, under Emergency Powers. After [press] leakages concerning the London tunnels, all building staff working on the Birmingham and Manchester projects were security vetted to prevent leaks." Peggy Kynaston of the Manchester Civic Society echoes the need for secrecy, declaring, "The [Manchester] tunnels were built in 1955 by Polish immigrants, chosen because they couldn't speak English." This seems somewhat implausible, however, unless these refuseniks had permanently fled their homeland and foresworn its communist regime.

Equally stringent security measures were in place in Birmingham. So as to reveal as little as possible to construction workers, the Ministry of Works drawings for one of the lift shafts declared it was for the Newhall Street station of the Birmingham underground, which, according to the story circulating at the time, was a scheme by the municipal authorities to move its tram routes underground in the city centre to reduce congestion. As one of the installation engineers recalls,

You were not meant to mention it except by name—Birmingham Anchor—but the entrance was in the basement of Telephone House and you descended in one of those slow grinding lifts the older London tube stations enjoyed. Down below was an obvious short stump of a station loggia area and then a smaller one where our equipment was trolleyed along to be installed in neat cream lines. I gained the impression that one side of the station had been completed, as it crossed the street and there was another entrance in



Ventilation shaft for the Anchor deep level trunk exchange in Birmingham - Photo by Sebastian Ballard

Brindley House opposite.

In fact the entire notion of an underground railway was almost certainly no more than a ruse from the outset—a cover story to explain the construction of these tunnel workings. Only a handful of tram routes remained in Birmingham by that time and the corporation was committed to replacing all of these by buses.

Newhall Street is not a highly trafficked location and there would no justification for siting a station there. Lifts would have been a luxury at a tram station during a period of relative austerity and in a Britain where no major investment in public transport was being undertaken elsewhere. An underground tramway scheme would make a good story for responding to press enquiries but overall it was doubtless just a smokescreen for concealing the true purpose of some highly secret works.

Communications in context: plans for protection



Stockport PR1 protected repeater - Photo by Nick Catford

Retrospective legislation

The construction work for Anchor, Guardian and also Kingsway in London was undertaken under the provision of the Post Office Works bill, which was debated in the 1958/59 session of parliament, at a time when the withdrawal of Emergency Powers made it necessary for the secret construction to be discreetly revealed and vested in the Post Office (as Duncan Campbell neatly puts it). The preamble of the bill stated that in the exercise of emergency powers the London Passenger Transport Board had constructed certain underground works situated partly in the Metropolitan Borough of Holborn and partly in the City of London, also in Birmingham and Manchester, and that the Postmaster-General had entered into occupation of those works and in the exercise of emergency powers had extended them. In all cases the works were described as "a system of tunnels together with shafts and other means of access thereto from the surface and ancillary works".

The Bill had its second reading by the Lords on 20th January 1959 and was committed to a Select

Committee. Petitions were deposited by five organisations, complaining that no indication of the depth of the works was given (withheld for security reasons), that no compensation was offered for any damage that might be incurred or for reduced property values and arguing that surface owners should have unrestricted rights to develop their land. In the event, the Act did not appear to excite any particular attention.

Facilities

The actual arrangement of apparatus and provision of facilities were similar in each of the provincial exchanges although Guardian in Manchester was built on a grander scale than Birmingham Anchor. A document of 1951 in file WORK 1281/45 at the Public Record Office list shafts to be constructed in London, Birmingham and Manchester (also in fact in Bristol, although the corresponding underground exchange in that city was never built). Interpretation of the list of shafts shows that at Birmingham and Manchester additional cable tunnels were planned, running at deep level until outside the blast radius of an atomic bomb



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dropped on the city centre, then moving up to normal buried level at an exchange. Whether these tunnels were completed is a matter for conjecture (the relevant files are closed) but there is circumstantial evidence to support this.

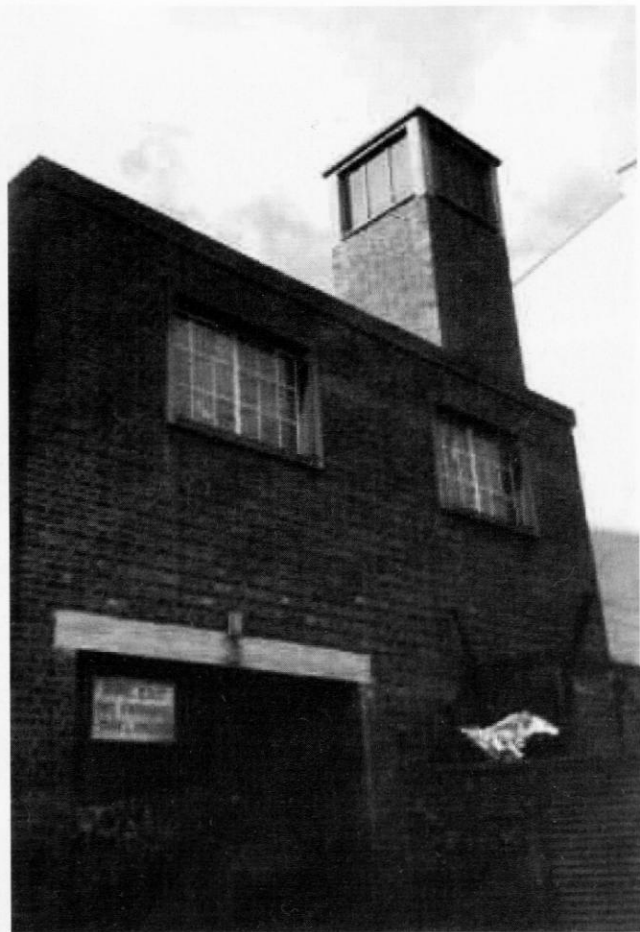
Facilities provided include the emergency manual switching system (EMSS) switchboard, the Strowger automatic apparatus room, a repeater station (coaxial and optical fibre), the main distribution frame (MDF) and cable chambers. Like Kingsway in London, Guardian had its own artesian well (shared with Boddington's brewery), generators, fuel tanks, and decorative artificial windows and scenery adorning the restroom walls. Sickroom, canteen and welfare facilities were provided too, along with emergency food rations to last six weeks. Staff selected to work in these facilities were vetted carefully and everyone needed special passes. True World War II-style warnings that "careless talk costs lives" went out too.

Manchester Guardian

The works in Manchester were completed in 1956, whilst the Anchor tunnels and exchange were first opened in 1958, according to an article in the Post Office staff newspaper. Along with Kingsway in London, Anchor and Guardian were 'protected' by D Notices until 1967 when they were de-classified. By the mid-1980s the analogue equipment in these exchanges had been rendered obsolete by newer digital technology and Anchor exchange closed in 1984; Guardian was retained as accommodation for BT power engineers until 1997. The tunnels are still kept under maintenance and provide valuable secure cable routes that do not involve digging up the roads. Manchester's tunnels lie between 100 and 200 feet deep, extending a mile and a quarter across the twin cities of Manchester and Salford. Extended between 1972 and 1974, they run from Ardwick on the south side, underneath Deansgate, beneath the River Irwell and westwards across Salford. A grid of large-diameter tunnels (up to 42ft across) under Back George Street housed the former Guardian exchange and repeater station itself (removed 1996) as well as other support systems. An extremely detailed and illustrated description of the underground works and surface features is provided on the website mentioned in the bibliography.

Anchor

In Birmingham on the other hand the extent of the underground exchange and associated tunnels was not disclosed until 1999 when the BBC Midlands Today news programme filmed them and fortuitously broadcast a close-up of the plans. These indicated two parallel tunnels running roughly south-east to north-



Ventilation shaft for the Guardian deep level trunk exchange in Manchester - Photo by George Coney

west, with a spur branching off the northern end to a circle on the plan, which is presumably a lift shaft and/or staircase. The approximate centre point of the tunnel is in Newhall Street, 100ft below Telephone House, where there are two entrances. The southern end of the complex is at Smallbrook ATE (automatic telephone exchange) in Essex Street, just off Bristol Street. As regards the northern end the Subterranea Britannica website states, "an uncompleted tunnel heads off towards Hockley and from Hockley back towards Anchor but they don't join, with a large gap where this tunnel was not finished. As completed it stops just short of the jewellery quarter. In the opposite direction the same tunnel reaches Essex Street, making it around 4,000ft in length. If the tunnel to Hockley had of been completed joining the section coming in the other direction it would have had a total length of 7500ft (the gap is 1,500ft).

Some idea of the capability of the exchange is revealed in a 1968 article in the Birmingham Post, which states that it handled 250,000 automatic calls a day in a system of tunnels 750 ft long. Civil engineering works for the exchange cost £4 million, whilst the equipment inside it cost another £2 million. The report continued that the exchange, approached through a



Communications in context: plans for protection

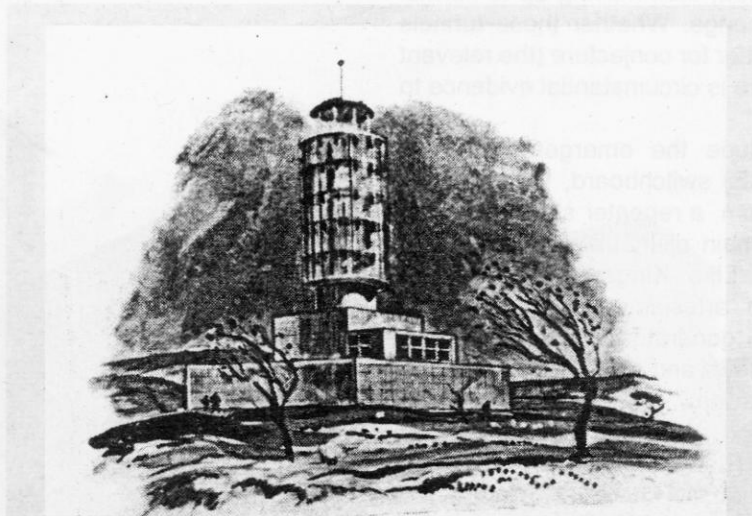


FIG. 13.—SKETCH OF PROPOSED MULTI-BROADBAND RADIO-RELAY STATION.

13

lift, could be sealed and had accommodation for 100 men (female staff were not allowed) who could live and work there for several weeks.

Although the exchange was by then no longer on the secret list, all staff and visitors needed passes and had to sign in and out, not so much as a security measure but to ensure that no-one could be left behind in the event of fire or flood, or if they fell ill and were left undiscovered in one of the small ancillary tunnels.

Emergency water supplies were provided by a 700ft-deep artesian well that tapped the same water shelf that supplies Ansell's Brewery, whilst three large diesel generators were provided to take over if the supplies from the Midlands Electricity Board failed. The last time the Post Office put the exchange on an emergency footing and was prepared to seal off the tunnels was during the Cuba crisis of 1962, the report concluded.

A contemporary report in the Birmingham Evening Mail added that the exchange had air-tight blastproof doors at the foot of the main lift shaft and the trunk unit built in the 28ft high tunnels carried 4,700 circuits and was also the central testing point for many of the main trunk routes to places all over the country as well as the control point for the BBC and ITV services in the Midlands. Two of the tunnels are 400ft long, one is 240ft and another 110ft and there are several smaller sections.

The exchange 'Anchor' gets its name from the assay office next door, the Birmingham assay mark being an anchor. Guardian of course takes its name from the daily newspaper formerly titled the Manchester Guardian, although ironically its role guarding Mancunians above ground would always have been nil. Both exchanges have resident ghosts, incidentally. Guardian is said to be haunted by one of the Polish

workers who fell to his death down one of the lift shafts, whilst several Anchorites have seen the ghost of a man killed by a rock fall in the tunnel.

Backbone

One other vital element of Cold War communications was the Backbone radio system and its 'radio standby to line' spurs. This has been described comprehensively in a feature entitled The Towers of Backbone at

<http://www.subbrit.org.uk/rsg/features/backbone/index.shtml>

on the Subterranea Britannica website.

Due functioning

How this network was intended to function under atomic war conditions is a matter for speculation, since thankfully it was never tested under real war conditions. Moreover, the Post Office war instructions of the time are not available for inspection. One might imagine that the network would eventually shrink down to the switchboards of the emergency manual switching system (EMSS) and the small number of 'trunk sub' subscribers connected to them (and to the normal manual switchboards above ground). Once electricity from the grid was lost, exchanges would keep going for a while using their batteries and emergency generators. The bulk of the public switched telephone network (PSTN) would have been disconnected altogether and it is possible that the automatic trunk exchanges would then service EMSS hubs alone providing interconnect.

From Andrew Emmerson



Cold War Tunnels at the Hotel Nacional, Havana, Cuba



Observation post and gun pit - photo Mark Dalton

The Hotel Nacional was built in 1930 on the site of the former 'Santa Clara' artillery battery, a few miles from Old Havana. The hotel still retains its 1930's splendour and is known throughout Cuba for the litany of famous guests that have stayed there.

As a guest of the hotel I was able to take a historical tour of the hotel and grounds. These grounds contain extensive underground workings.

The workings consist of a series of open trenches and concrete and earth covered tunnels which link three anti-aircraft gun pits to each other and to a small underground observation post. In addition at least one tunnel connects the site to the hotel itself.

The system was supposedly built around the time of the Cuban Missile Crisis, although I was unable to ascertain exactly when. Further work would seem to have been carried out since the crisis as the central gun pit has now been roofed with a concrete slab and earth covering. This is now used as a small museum and is the start and end point of the short guided tour that is available.

While the concrete pits held anti aircraft guns, the tour guide tended to describe the system as being built for the protection of the hotel staff and guests.

The central gun pit has short tunnels leading off in both directions. The right hand tunnel has an arched concrete roof and a small room off this contains ammunition boxes as part of the museum display. The left hand tunnel has recesses in its walls for further ammunition storage.

This left hand tunnel exits into an open trench which links up with the left hand gun pit. The entrance to this gun pit is now sealed. Before reaching the sealed entrance there is a step down to a concrete roofed tunnel that goes backwards in a diagonal towards the hotel. This links to a small observation post which has three small chambers. According to our tour guide the central chamber held a periscope type device, and there is a pipe like equipment mount still in place here. The two chambers on either side have steps up to surface openings (the central chamber opening has been sealed). There is also a small display cabinet here containing a uniform and a piece of aircraft wreckage.

Exiting the observation post area the tunnel continues around in the direction of the right hand gun pit. The tunnel passes the entrance to the right hand gun pit before exiting into an open trench which leads back to

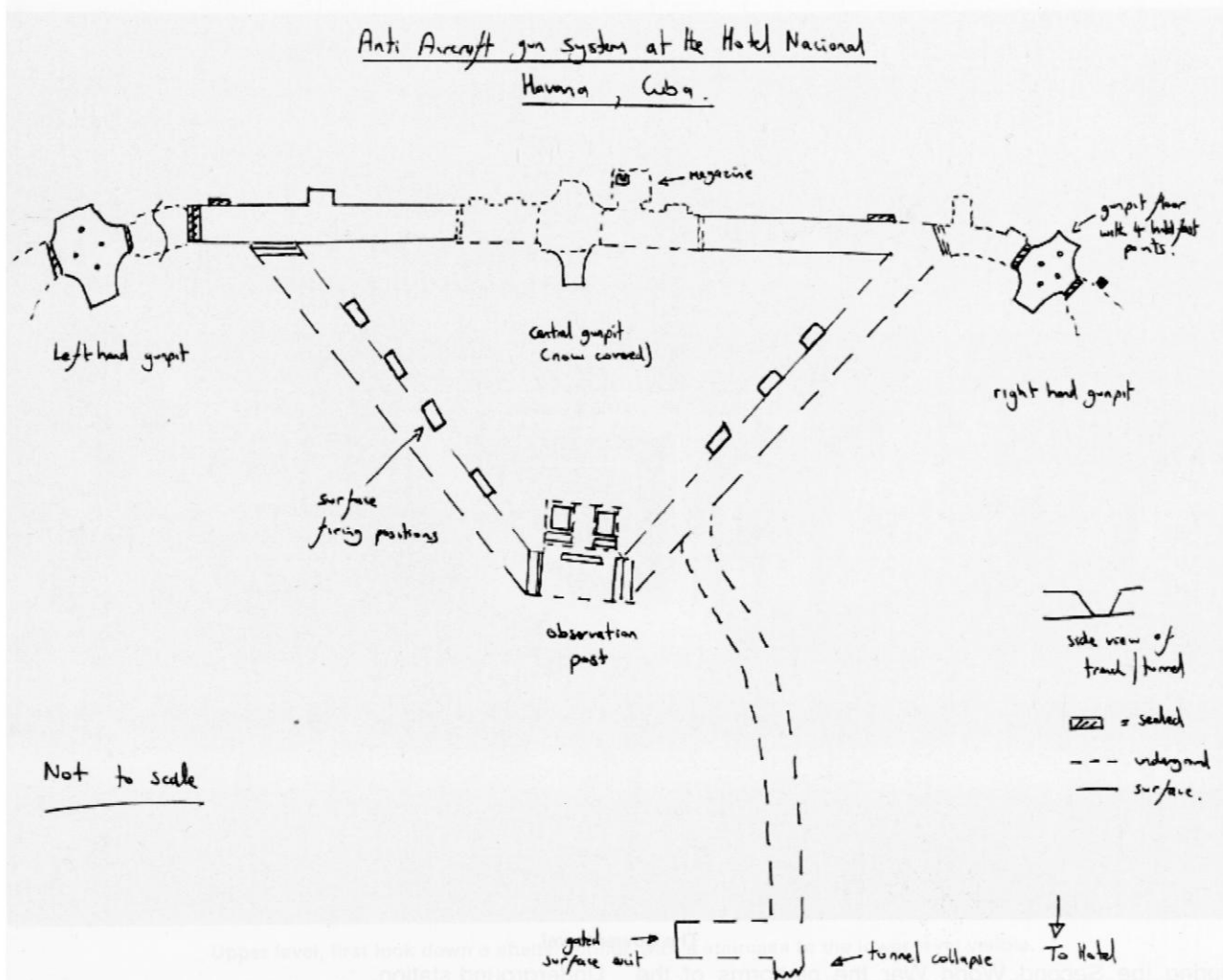
Cold War Tunnels at the Hotel Nacional, Havana, Cuba



Above: The Display area. Below: The Right hand gun pit with Havana in the distance - Photos Mark Dalton



Cold War Tunnels at the Hotel Nacional, Havana, Cuba



Sketch Plan of the AA Gun System at Hotel Nacional Cuba - By Mark Dalton

the central gun pit. It is interesting to note that the right hand gun pit is accessed via a step down while still in the underground tunnel whereas the left hand gun pit was accessed from an open trench. The right hand gun pit is only partially blocked off and could still be accessed, although this was not possible on my visit. The two main tunnels linking the left and right gun pits with the observation post were well lit and ventilated with 3 to 4 openings to the surface in each tunnel. These took the form of recesses in the tunnel walls leading to the surface. Metal covers on the hotel lawns protected the guests from injuring themselves. At least one of these openings had metal rungs set in the concrete and the guide indicated that the openings were used as firing positions. Besides the main tunnels there was one further tunnel. This forked off from the main tunnel just after the observation post had been passed (moving towards the right hand gun pit). This was a sharp right hand fork which ran back towards the hotel. This tunnel contained no surface openings and continued until barriers and a roof collapse stopped progress. At this

point the tunnel was quite close to the hotel and the tour guide informed us that tunnels used to run to the basement, kitchens and underground car park of the hotel. Just prior to the collapse there was a further fork in the tunnel which exited at a gated door in a mound near the hotel's outdoor restaurant. This short tunnel was not accessible but appeared to be all concrete rather than the cut and cover construction of the main tunnel system.

Summary

The whole system is very close to the surface and uses a cut and cover method to link the hard points of the anti-aircraft system (gun pit magazines and observation post) to each other and to the hotel itself. While the system is fascinating and accessible it also leaves many unanswered questions and there is plenty more to be discovered. I would highly recommend a visit if in Havana. The tours are free and can be booked at the reception in the hotel.

From Mark Dalton



Clapham North Deep Level Shelter



The Lower Level

During the Second World War the platforms of the London Underground became increasingly used overnight by the general public as air raid shelters (despite being initially discouraged). Work began in 1940 on building deep level shelters beneath many of London's central Underground stations with a vision of eventually converting them into express Underground routes through the centre of London in parallel to existing lines such as the Northern Line. The shelters were built during 1941-1942. Some, though not all, were used for their intended purpose of providing public civil shelters beneath London's streets.

When hostilities ended, these tunnels remained under the stewardship of the British Government for many years. The initial plan of incorporating them into an express rail route through the centre of London was initially shelved and then abandoned due to the lack of money after the War. Then, in the 1990s, London Underground was given the opportunity to take control of the shelters with a view to leasing them out. Since then, the deep level shelters have been progressively leased to companies interested in using them to store items such as documents, film, videotapes and other similar archive material. The last of these tunnels to remain un-leased was the one under Clapham North

Underground station.

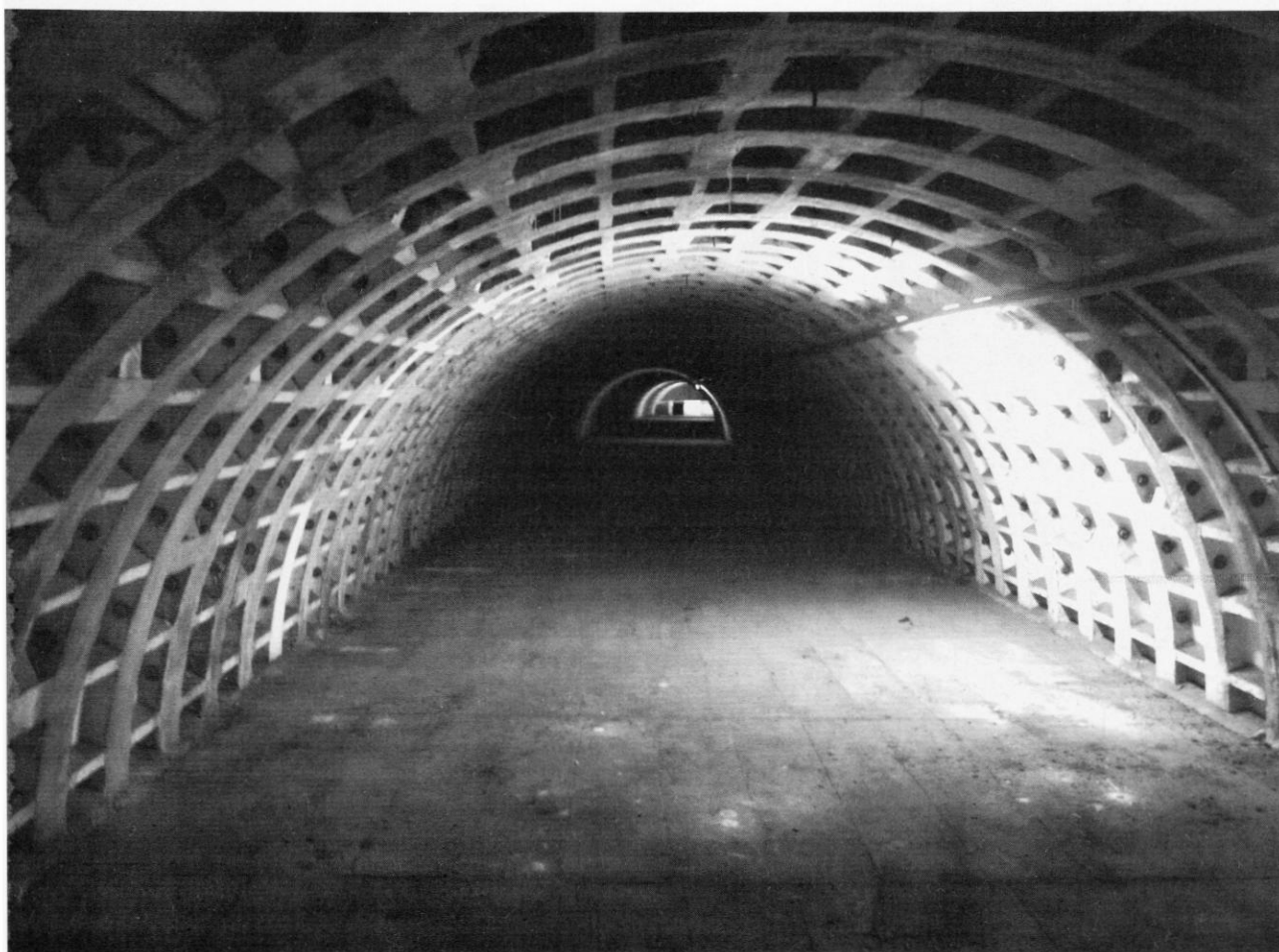
In 2006, Transport for London advertised the lease for Clapham North deep level shelter using a national commercial estate agent. A bidder was soon found and a lease drawn up so that the shelter area could be used for document storage. Shortly before the lease was taken up by the new tenant, a small group visit was permitted for the Clapham Society, a local civic amenity society, which works to protect the environment and to strengthen local identity and sense of community. I was also invited along as part of this visit to document what was there, shortly before its use and purpose would be completely changed.

The Surface

The visit was due to enter the complex using the familiar looking concrete blockhouse structure that provides the entrance to the shelter not far from the main Underground station. Due to a minor technicality (someone had changed the locks) we found ourselves standing outside the far less used and far more interesting second entrance just behind Clapham North station. Interesting because this entrance is unique in its construction when compared to all the



Clapham North Deep Level Shelter



Upper level, first look down a shelter tunnel, with a staircase to the lower level visible.

other deep level shelters in that it doesn't have the familiar round block-house structure on the surface. Rather, there was a collection of three small squat structures that provided the site's ventilation and entrance.

There was a short tower that was originally used as part of the site's ventilation system. Written on this tower on a weather-worn wooden sign was a sign from the Ministry of Public Building and Works. This was not an original World War 2 sign of course; the Ministry of Public Building and Works came from the earlier Ministry of Works, which was formed in 1943 to organise the requisition of property for Wartime use. The ministry was renamed the Ministry of Public Building and Works in 1963 and then became part of the Department of the Environment in 1970. It is highly likely therefore that this sign dates back to the mid 1960s.

Immediately to the rear of this small building was a large round "manhole" cover over a square concrete block. This actually covered the site's main ventilation shaft which ran vertically down to shelter level. It was in fact an exit vent - when the shelter was in operation, waste air would have been pumped up this shaft (using powerful air pumps situated on the shelter level) and

fresh air was allowed to flow down the two main entrance shafts. Originally this shaft would have had a short tower constructed above it so that air exiting the shelter wouldn't have mixed with air being sucked in, but this had long since been demolished.

Not far from this there was a second structure of similar design to the first squat building, with some slats in its roof - obviously for ventilation. On initial examination this could have been mistaken as the site's main entrance but it turned out that the small door in front of the roof with slats was only a storage room that originally contained some plant, probably to do with the shelter's original emergency power supply, now a simple store room. The site's entrance was actually immediately to our right as we entered the small yard. Once opened, a short corridor led into a small, unlit entrance lobby which led to a small office room and the top of a staircase.

The Descent

Most of the deep level shelter spiral staircases start in the round concrete pillbox building above surface, which also acted as protection from being struck by a bomb. The pillbox contains the lift machinery and the



Clapham North Deep Level Shelter



Lower level, entrance to women's toilets

top of the double-helix spiral staircase down to shelter level. This entrance however turned out to be quite different. The initial descent was to be down two flights of a wide staircase down a tubular tunnel. Originally, this staircase would have been well lit, but in our case all the lights were off and in most cases had been removed - in fact, the entire descent to the shelter levels would take place only under the light of hand held lamps. I presume this staircase served a similar purpose to the blockhouse in that only a direct hit by a bomb would provide any threat to the shelter below.

As we descended the staircase, some light could be seen filtering in through the roof. Looking up, the slats of the ventilation structure we'd seen from the courtyard could be seen, this time from the inside. Covering these slats, the remnants of a series of filters could be observed. During the shelter's use as an air raid, these filters would have prevented dust and fine debris from bomb damage entering the shelter's ventilation circuit during the blitz. The filters themselves turned out to date from around the 1970s and weren't original units dating from the 1940s.

At the bottom of this wide staircase, the tunnel effectively became a T-junction, diverting into two short narrow corridors, to our left and right. These corridors

quickly doubled back on themselves and entered into a tight spiral staircase. These were the heads of a double helix staircase, with each staircase leading to a different level of the shelter beneath. The left passage led to the staircase to the top deck of the shelter while the right led to the bottom - a double helix spiral staircase with two staircases in one shaft, 180 degrees out of phase with each other. In the centre of the spiral staircase was a void, encased in a metal mesh, which would have originally been occupied by a lift. This was not predominantly designed to provide passenger access to the shelter; rather it was to provide provisions for the shelter's canteen and other goods. It was a lengthy climb down. Apparently the shelter is four storeys lower than Clapham North station. We were told that the shaft we were initially intending to descend had 176 steps. This one had a few less because of the generous initial staircase; nevertheless, it still felt like a long way down!

The Shelter – Top Level

Once at the bottom we found ourselves in a relatively wide cross-tunnel, which linked the spiral staircase to the two 1400 foot long shelter tunnels. This cross-



Clapham North Deep Level Shelter



Looking back towards the spiral staircases in the crossover

tunnel has an interesting construction design. Although we knew that we were in the top level of the shelter, the tunnel we were standing in was far more than a semi-circle in shape, considering it was supposed to be a two level tunnel. In fact, it was almost unique in design and the construction of the deep level shelters in London was the first time such a tunnel had ever been built using this form. Essentially it took the form of a figure 8 - two bisecting circular tunnels had been mined to form the top and bottom level of the crossover in order to provide more space.

As we walked the regular noise of trains passing through Clapham North station four storeys above our heads could clearly be heard - this just added to the surreal atmosphere of this location. In fact, this sound was regularly heard throughout our visit, a reminder of the fact that this location could so easily have become a part of the Underground network had things happened differently. Before reaching the main shelter tunnels, two short tunnels branched to our right. The first one branched off to what would have been the shelter's men's toilets and the second went to the women's toilets. All fixtures and fittings had since been removed but the location of where the urinals had been could be clearly seen on the walls, as could the

blocked off drainage pipes and marks in the walls where the stall walls had once stood.

As we walked down the crossover passage, thin straw like stalactites could be seen, some more than 2 feet in length, where minerals in the rocks outside the shell of the structure had leaked through over the years, depositing formations not dissimilar to those seen in caves. These were hollow and most had a drip of water waiting to drop from their ends. As well as the stalactites, very short but stubby stalagmites could be seen forming on the floor. People walking through the tunnels have probably worn some of these down over the years, but some bore an uncanny resemblance to features more commonly observed in show caves forming short stubby stalactites and in some cases features that resembled fried eggs!

At the first shelter tunnel we came to, the tunnel to the right was in complete darkness as it ran way into the distance. Even with a powerful lamp it was impossible to see the end of this tunnel, such was its length and in the distance it could be seen to curve slightly to the right. This main tunnel was clearly different in construction from the interconnection tunnel. It was clearly a circular tunnel with the floor effectively bisecting the circle in its diameter. A small concrete

Clapham North Deep Level Shelter



Staircase up to Clapham North station (now blocked) from shelter

staircase ahead of us could be seen leading down to the bottom level of the shelter. Practically, these would not have been in use by the shelterers. Each person using the shelter would have been assigned an entrance, level and location within the shelter. The concrete stairs are there mainly to provide emergency access and also for the wardens and administrators to manage the location.

The tunnel to our left however was dimly lit - about one in every four of the strip lights that had been installed were working, giving an eerie illumination to the location. At this point we could see the two modes of construction employed in this subterranean structure. Initially we had been walking through a tube made of cast iron rings. However, as we continued walking, the tunnel walls turned into concrete rings. Apparently the original intention was to use concrete throughout, but the time required to make the pre-cast concrete rings was prohibitive, so a combination of both methods eventually was used.

This upper section took an open, semi-circular form. The floor was a metal mezzanine and the circular rings of the iron/concrete walls seemed to spiral into the distance. When the shelter was in use, the top of this tunnel would in fact have appeared flat, however today

it formed a smooth arc. This is because there would have been a foul air duct running along the entire roof of the tunnel to allow waste air to exit. Nothing now remained of this duct throughout the complex apart from occasional short support struts.

We walked down to the end of this tunnel which was about 100 yards, avoiding some of the lengthy stalactites along the way. When we reached the end there was a small staircase leading to a small void beyond, which acted as an intersection between both levels of each tunnel and also between the two shelter tunnels - this is one of the few places where all four of the main shelters interconnected. We used this intersection to walk over to the second shelter tunnel and down to the lower deck. Once out in the lower level, it became apparent that this lower level looked quite different from the top section. We were now in the bottom half of the circular section of the tunnel.

The Shelter – Bottom Level

Unlike the top level where the tunnel clearly formed an open, semi-circular shape, the bottom appeared a lot more confined. There were three reasons for this:

- Because the flat mezzanine structure that divided

Clapham North Deep Level Shelter



Main staircase down towards the spiral staircaseLower level

- the two levels needed support, there were regular posts along the tunnel length to provide this support.
- The floor of the upper level was the flat mezzanine platform. The bottom level didn't have this luxury and had to have a flat floor built otherwise we'd have to negotiate the concrete and iron rings in our walk. This made the space between roof and floor noticeably lower.
 - One side of the tunnel was noticeably higher than the other. This is because, unlike the upper level, the waste air duct remained in place, and ran the length of the tunnels to one side, giving a lopsided appearance to the lower deck.

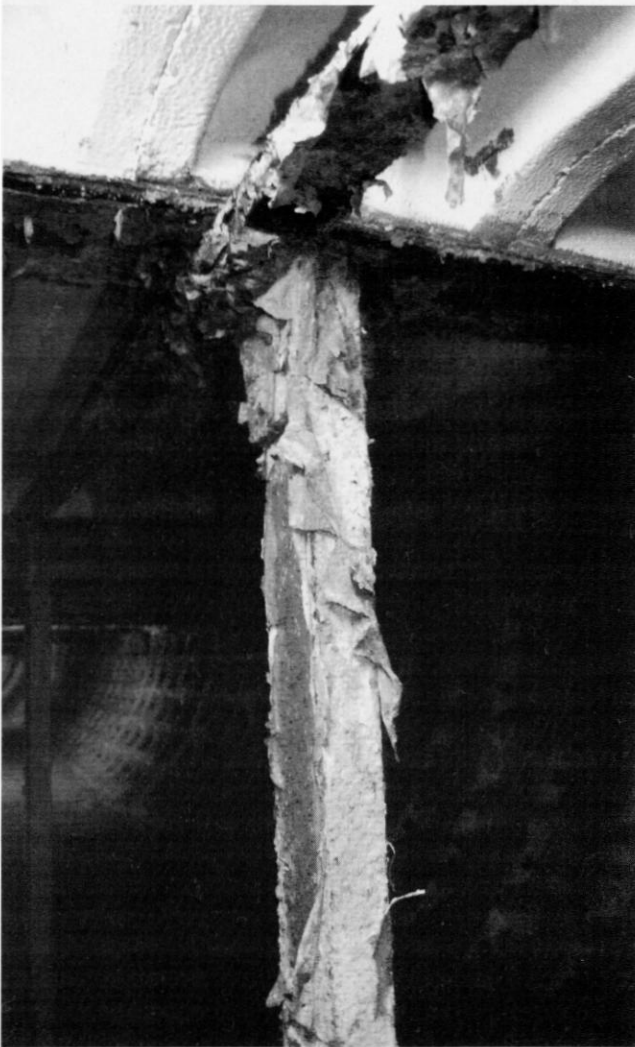
Because of the many support struts, there was an eerie feeling that we were in a prison due to the image perceived of endless bars running into the distance combined with the mild claustrophobia caused by the low roof. On this level, bunks would have been arranged to allow for maximum capacity in the available confined space. To the left, above the waste air duct, the bunks would have been arranged perpendicular to the tunnel wall, providing three levels of sleeping. To the right, where there wasn't so much space, the bunks would have been arranged in parallel

with the tunnel wall, again providing three bunks per bedding area. We continued walking down this tunnel until we reached the crossover passage that led back to the spiral staircase with the toilet blocks. These, we could see, had been duplicated here on the lower level. The crossover passage seemed to continue on past the two main shelter tunnels for a short distance. This short section provided one of the medical stations that supported the 8,000 people that were expected to shelter here.

Continuing down the lower tunnel, a distinct curve to the right could be seen along its length, accentuated by the regular red metal pillars. This tunnel felt considerably drier than the upper level. It was also a lot dustier and a thin mist of dust formed as we walked. Despite appearing drier, the occasional mineral feature could still be observed on the walls and also the metal pillars along with their paintwork in places were starting to show their 60 odd years of disuse with peeling paint and rust.

After walking for some time we came across a concrete wall with a doorway. This was part of the ventilation system, to control the flow of air in the structure. Shortly after this wall, a small cross passage was seen, which had a wide stairway leading upwards

Clapham North Deep Level Shelter



Some paint peeling on one of the lower level pillars

from it, between the two shelter tunnels. This stairway didn't stop on the top deck. but continued on for four lengthy flights before ending with a brick wall.

This in fact was the shelter's third entrance, now no longer in use and indeed the brick wall formed a dead end at the top of the staircase. As well as the two "surface to shelter" spiral staircases, a third entrance was originally provided for each of the deep level shelters that joined directly with the platform levels of their associated Underground stations. This would allow people from further a field to come to their designated shelter.

Instead of risking a journey from the platform to surface and then back down again, these people were able to disembark their trains and proceed directly to the deep level shelter along the staircase in which we were standing. I understand that this third entrance would have originally come out nearby Clapham North's emergency spiral staircase, but there's little evidence of this in today's busy station. Due to the lack of air circulation here, unlike anywhere else in this

shelter, the air in this staircase tunnel was dank and stale as there was no longer any means of circulating the air here. Continuing down the shelter tunnels, we came across yet another wall with a doorway across the shelter tunnel. This turned out to be the crossover passage for the second spiral staircase that should originally have been our entrance into the complex.

Here we saw all the features we'd seen in the first crossover duplicated - two sets of toilets (two on each level) and the short overrun to provide room for the medical posts. Although we were on the bottom level, a short length of spiral staircase appeared to continue downwards in the stair shaft. This was in fact the way to the complex's plant and control room where electricity, ventilation, water and sewage were managed and controlled.

Today however, virtually everything had been removed. The compression system used to eject sewage from the nearby toilets had been dismantled and removed, as had the transformer and mercury arc rectifier that once powered the lift (though there were still marks on the walls and floor where they used to stand). Only some basic electrical controls remained on one wall. Thankfully, a similar control room still remains virtually intact in Belsize Park deep level shelter complete with a working mercury arc rectifier. During our walk back to the spiral staircase to the surface, it was observed that the toilets on the lower level still had their gender designations. This is probably one of the only remaining signs left over from the original shelter construction found in the shelter area itself.

Since we were entering the spiral staircase from the bottom shelter deck, although we were climbing up in the same stair shaft, we were on a completely different staircase and emerged in the other short passage onto the wide staircase at the top of the spiral stairway. Along this staircase, some temporary lighting had been erected, now long abandoned. This was left from when some electrical modification work was conducted, probably in the 1990s. At the top of the spiral staircase we passed the original lift entrance, now blocked by a recently added aluminium plate. Next to the plate however, a sign was left over from when the lift was in operation, giving instructions on its use that read: "NOTICE - ONE PERSON must remain on the landing when lift is in motion so that help may be obtained in the event of a breakdown".

All that remained was to climb the wide staircase and we were in the small lobby area in the surface building and then out into the fresh London air on the surface. Since the visit, people have reported that work is already underway to install lifts and to prepare the location for use as a storage facility

Text and Photographs From Hywel Williams



Swedish Trip November 2006



Above and Below - The Unique aircraft shelters, on the taxiways at Eskilstuna - Photo By Mark Bennett

Organised by Dan McKenzie at the UK end and Lars Hansson at the Swedish end, the tour took place from the 11th to 14th November (Sat to Tues).

All participants gathered at Stansted Airport for the 0625 Ryanair flight to Stockholm Skavsta, some having left home as early as 3am! After our 7-minute early arrival at Skavsta we were met by Lars and made our way to the hire car pound where we collected our hire cars, Volvo's naturally.

Skavsta was formerly an Airbase being used by a Reconnaissance Flotilla (The Swedes call their Squadrons Flotillas) some of the barrack blocks were visible now sold off, however there is a brand new civil air terminal.

To the west of the airfield was a long taxiway with dispersals in the woods for aircraft about a mile from the runway, we did not have time to visit this as our programme was to cover some very long distances with 400km to our first overnight stop at Gavle. The airport is 100km from Stockholm but serves the well populated Nyköping area.

After stopping for rations in a village supermarket we headed to our first site just outside of Eskilstuna 100km from Skavsta. The Swedish Air force relied heavily on dispersing its aircraft well away from airbases and having Highway air strips.

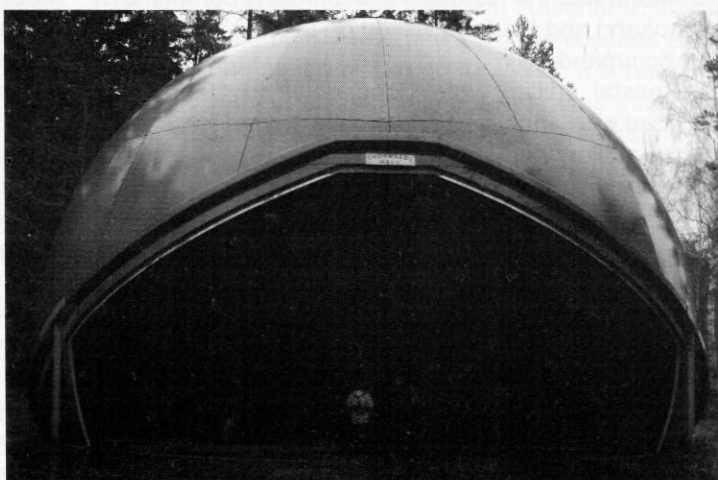
There were 2 types of Dispersal,

- BASE 60 built in 1960's and 1970's with highway strips away from main runway and dispersal hangers and hard standings alongside public roads.
- BASE 90 a similar pattern but more extensive and built in 1980's.

We visited a 60 BASE on our last day which will

be described later, but today we were at a typical BASE 90. This consists of a main runway and control tower, 2 dispersal areas along public roads linked to the main runway by lengthy taxiways. There are 2 Highway airstrips and hard standings for aircraft along the highway. On some of the hard standings, metal poles, that held the camouflage netting were still extant. We only had time to look at 1 dispersal - airstrip area. The airstrip is about 1 km long and the road widens to twice its size, however the area with roadside dispersals is approx 3km long. On the taxiway from road to runway were 2 fascinating hangers, which only a photo can really describe, these were a new prototype type of design for dispersal areas.

At the junction with the runway was an alert area with 2 simple alert barns, the whole complex was designed to be disguised from the air. The base underground command post again dispersed from main runway area has been demolished and could not be visited. By



Swedish Trip November 2006



The Range Finder in the Coastal Artillery Fort at Gavle - Photo By Dan McKenzie

now the rain was heavy ! and we retreated to cars to have our lunch.

Then we began our long 200km drive to Gavle. Swedish trunk roads are very pleasant and quiet compared to UK. After a brief stop for food in Soderhamn we arrived at Gavle after dark (At the time of our visit its dark by early afternoon).

Gavle was the HQ of an Infantry Regiment, the main command was the Northern coast artillery command atarnosand and the forts visited on this trip were under that command.

All Coastal artillery was stood down in 1993 being replaced by marine craft and mobile ground forces with mobile artillery and anti ship missiles.

Many fortifications have been destroyed or capped with concrete; the three forts at Gavle are preserved. In 1993, 4000 military facilities were shutdown, many were simple pillboxes or tank turrets mounted in concrete emplacements Three Forts built from 1957 onwards defended Gavle harbour, we visited Fortet Gavle, located on the Furuskar Furuviksparken (Amusement park) and maintained in splendid condition by the owners of the park. It was de activated in 1984.

The Fort consists of a central command post with

tunnels linking to 75mm gun positions either side. There is also a detached 75mm gun position now stripped out, but the main complex is as if the Swedish army were still there. It is located on a tiny island linked to the amusement park by a narrow steel bridge. In the rain and darkness we toured the surface features that included the site of two 12 pounder guns, a semi sunken shelter for housing searchlights, and a mobilisation shed complete with its Searchlight.

On entering the Underground section you first come to standby generator and then proceed to the first gun and magazine. (The 75mm gun is equivalent to 6 Inch guns widely used for UK coast defence in WWII). Next on the right is the rangefinder station with rangefinder intact and then the Battery Command post.

Although slightly updated in later years it gave a good impression of what a UK Coast battery would have been like in the 1950's, for instance South Foreland at Dover in Kent.

On the left a passage went to the barracks and mess area with bunks still in situ, and then on to the emergency exit. Further along main tunnel is gun No. 2 and lastly the Battery commanders office and sleeping quarters.

Reluctantly we left the warm and headed through the



Swedish Trip November 2006



The 1980's "SK16" Shelters At The Infantry Base in Gavle - Photo By Dan McKenzie

cold rain to our excellent Youth hostel accommodation in Gavle town centre.

Day 2

We drove to the outskirts of the town to a large Army infantry base, now closed and being converted to a business park. However to defend the base the Swedish Army had, in the 1980's built four infantry defence positions each with trenches and a personnel shelter to a standard design "SK16"

Still intact, and now located in a public park area they were eagerly explored. All of the shelters were open and accessible. The site was last use was in early 1990's for an exercise.

We then drove the 300km to the Island of Hemso. After lunch we arrived at the Ferry, which runs every 30-45 minutes the short distance to the Island.

Hemso was a closed area to foreigners and a large multilingual sign warned of arrest, the languages included Russian and English. The sign is now preserved at the main fort on the Island.

The Island had a main Fort built in 1953 in the centre of the island with two 15.2cm guns replacing the two 1920's forts much like the fort of Siaro visited on

previous trip and now a museum, with two smaller costal artillery forts built in 1960's and 1970's with 75cm guns.

Only the main fort and one of the costal artillery forts at north end of island remain. This latter was our overnight location staying in the twin-bunked officers rooms of course, not the open all ranks Bunk area! The others Forts were demolished.

This fort is owned by the Swedish National trust and leased to a company who use it for conferences etc, it is maintained as if ready to go for WW3. It is not open to public without an appointment. It seems incredible that it was built only in 1963 as it appears straight out of WWII it replaced the 1920s fort at Dalom.

The Fort is a similar design to Femore fort visited on an earlier trip however a real highlight is a Mine control station 100% intact complete with Decca radar console which controlled the adjoining minefield.

Before the light faded there was a scramble across the rocks to photograph the exterior of the guns and command post.

Like rangefinders on all Swedish forts this one was housed in a wooden shed, for weather protection, and would have been removed in time of war, the guns disguised as rocks and extensive tree cover would



Swedish Trip November 2006

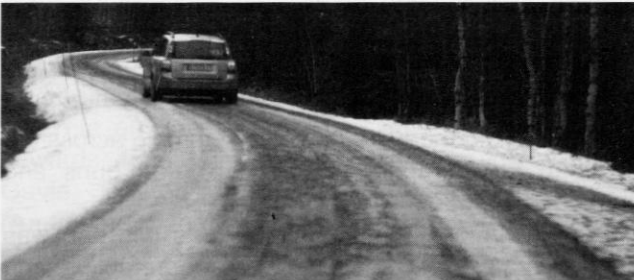


75mm Gun at the Artillery Fort on the Island of Hemso - Photo By Dan McKenzie

have made the site difficult to see from air. As the light faded we retreated underground to explore the long tunnels to the gun positions and the command post. We spent most of the evening examining the fort with great attention being paid to the laser rangefinder. The owners of the bunker prepared a traditional Swedish meal for us and after dinner in the mess, and a little more exploring, we retired reluctantly to our bunks.

Day 3

Our day started with a short drive, along ice and snow covered roads to the centre of the Island to visit the



The Ice and Snow Covered roads on Hemso - Photo Mark Bennett

islands main fort built in 1953 but heavily modernised in later years and only given up by the army in the last few years.

The fort is open to the public, Tues to Sun, from 1100am to 5.00pm in the months of July to August. For further information on the fort and its opening times, check their website at www.hemsofastning.se

Our attractive female guide met us at the wooden guardhouse and we walked through the wooded terrain to see the exterior of the three 15.2cm guns (these are in Turrets and were diverted from an order to Siam) On the mountain above the fort was a still active Air force radar station .

We then entered by the main vehicular access tunnel, after the usual dogleg we came to the main blast door beyond here to the left were dormitories and entrance to tunnel to guns No. 1 and No. 2. To the right was large mess area and tunnel leading to No. 3 gun and the command post, ahead was the generator room and hospital complex.

We were eagerly shown around Gun No. 2 after negotiating the 180 concrete steps we entered the 3 level Turret and tried our best to squeeze in the very cramped space in firing operators position reached by



Swedish Trip November 2006



Vehicle Entrance To The Main Fort on Hemso - Photo By Dan McKenzie

a series of ladders.

There was a shell magazine and very modern telephone room. As the other two guns are identical we were shown only gun No. 2.

We then explored the small fully equipped hospital many of us trying on the medical chiefs large hat for photos! there are two small wards and an operating theatre.

Next the we visited the large generators and then on to the adjoining canteen and messing areas. We then traversed a long corridor with 30 twin bunked dormitories obviously modernised in 80s. halfway along corridor was Command post, this had a plotting room with 2 PPI Radar screens and plot maps, adjoining this was battery commanders office , telephone and teleprinter rooms and a well stocked library with coast artillery yearbooks etc a treasure trove.

Right at the end of the corridor was the Fire control room for the Island defences. This coordinated fire from each forts battery command post. This was very modern with 4 radar screens and plot map. (There was a reserve fire command post on island that we visited later.) after passing though blast doors we exited through a natural stone tunnel before walking through

the woods to our cars at the main gate. A number of mobile fire control radars were displayed en route.

This Fort is without doubt the Highlight of Swedish defence heritage and is a National monument, in contrast the two other turret guns diverted from Siam mounted on the island of Gotland have been demolished along with every defence structure on the Island.

It is hoped the fortified Island of Landsort in the South will not go same way but defence chiefs seem intent on destruction.

Next we travelled to the reserve fire command post (measuring station) built in 1973. This three level bunker is accessed through a wooden shed, with a blast door in floor, which lifts to reveal ladder access to main bunker. A plotting room with 3 PPI Radar screens was the highlight. Although the reserve the station could work in conjunction with the main fire control to increase control from three guns to six guns firing simultaneously. On the surface the antennae could be raised after blast door opened, the range finding radar was again protected from the elements in another wooden shed. The whole Fort complex closed in 1993. We now travelled south to our overnight stop in Soderhamns where we would stay in the towns old



Swedish Trip November 2006



One of the entrances to the reserve fire command post (measuring station) on Hemso, built in 1973 - Photo By Dan McKenzie

Civil defence bunker!

On the way we had a brief look at the entrance to the Civil defence bunker at Sundsvall, built into a hill at back of town and now being converted to a security companies alarm central.

We arrived at Soderhamns and had a very slippery walk on ice and snow up to the two level civil defence bunker located in a hillside near to town centre.

After dinner in a very reasonably priced restaurant we retired to the bunker for exploration and sleep. All these types of bunkers are obsolete with a new structure to civil emergency planning, instead using bunkers or secure areas in or under the fire stations in every major town. The site can be rented out for conferences but the town council would ideally like to sell it. All the original equipment is intact, and original bunks were used by us to sleep in .

The ops room is ready to go with wall maps and phones, however the air raid siren console was disconnected! It is a type of bunker known as Ledning central and was a standard design used by each major town , being subordinate to the County and finally Regional civil defence bunkers. It was built in the 1950's and heavily upgraded in the 1980's with EMP protection added, the original plans were in a cupboard.

However what made this one unique was that if you

used the emergency exit tunnel, passing the two standby generators you exit into a cutting with a massive tunnel entrance ahead of you !

This is one of a number of bunkers built to a standard design by SJ (Swedish railways)to house rail mounted mobile transformer stations , that could be moved to remote locations during wartime and plugged into points or remain in their protected bunkers. From various research sources there appear to be 16 of these built between 1947 to about 1968. There are also non protected static transformer stations as most of SJ is electrified. There were also protected control rooms to control substations and transformers in a given area.

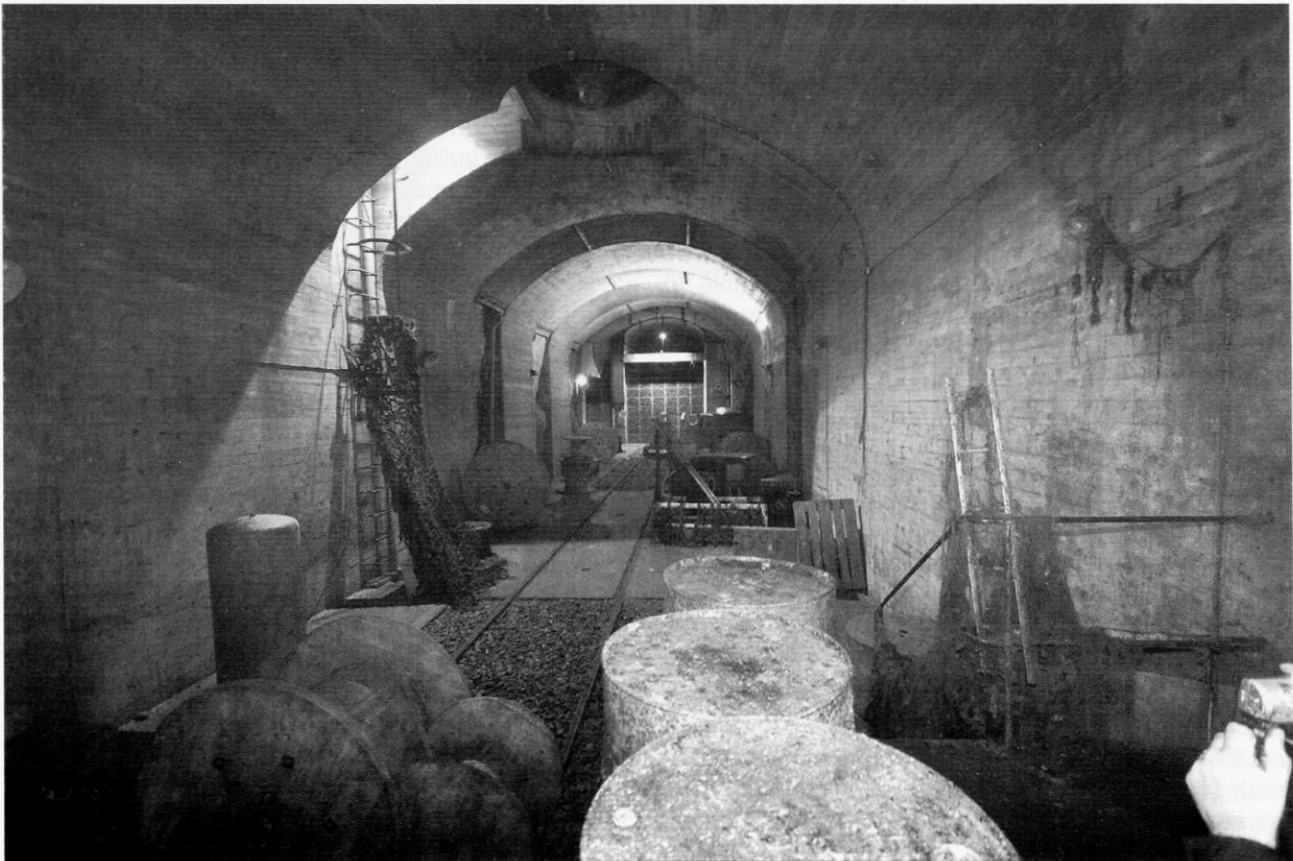
The complexes are to a standard design with slight variations and Soderhamns one consists of two massive high parallel tunnels, at the end were rooms housing electronic equipment in cabinets and mess areas. The workshop was intact with tools but all other rooms had been stripped. A cavern was excavated and the concrete structure of the station built within.

At the rail entrance massive blast doors consist of a steel frame with compacted stones held in place by wire mesh. The rail track is intact in the bunker but connection to main line had been lifted.

Swedish Trip November 2006



Above - the Radar display room at the reserve fire command post (measuring station). Below - The Railway transformer bunker at Tillberga now used as a paintball range - Photos Dan McKenzie



Swedish Trip November 2006



Entrance Tunnel to the Civil Defence Bunker at Enköping - Photo By Dan McKenzie.

Day 4

Next day we headed south via some interesting sites to catch our evening flight home. First call was at Tillberga where one of the rail transformer bunkers had been opened up for us.

To an almost identical design as the site at Soderhamns, but now in a terrible state as the site is used as paintball venue, however we were able to scale the internal ladders and see the massive concrete covers on the airshafts on the hill above.

Next to the town of Enköping where Lars had arranged for us to view the Ledning central for the town. Fully intact for civil emergencies and with a lengthy emergency exit tunnel cut in natural stone. A lot of books and directories made for interesting reading.

Like Soderhamn the main entrance is a discreet entrance in side of hill in residential district with a normal door, then long tunnel to the double blast door main entrance and again on two levels.

Continuing on near the town of Stragnas we saw a vehicle size tunnel entrance next to a roundabout. This was the County military HQ for Sodermanlands county (each county had a military HQ bunker) and Lars had been told it was sealed but clearly it wasn't !

The other side of the town was a good example of a BASE 60 Dispersed airfield, the straight highway strip was clear to see, two hangars survived alongside a aircraft hardstanding, the hangers were a conventional steel framed building each for a single aircraft.

With darkness upon us, Lars had one last treat in his home town, a friend was to show us the fallout shelter in basement of his block of flats, entered by a normal door, down a corridor and to a blast door the shelter area had a hand cranked air filter. Like most of these shelters now used to store residents bikes!

Every new building in Sweden had to have a shelter and they are standard in Government built flats. The location given away is the standard orange civil protection sign above the door. We observed a number of these during our days travel.

Finally we travelled back to Skavsta for our Ryanair flights back to the UK.

Thanks to Lars and Dan for organising an excellent adventure, for me as a Coastal artillery fan it was breathtaking! It is a shame that more of Sweden's Cold war heritage cannot be retained for museum purposes.

From Keith Ward

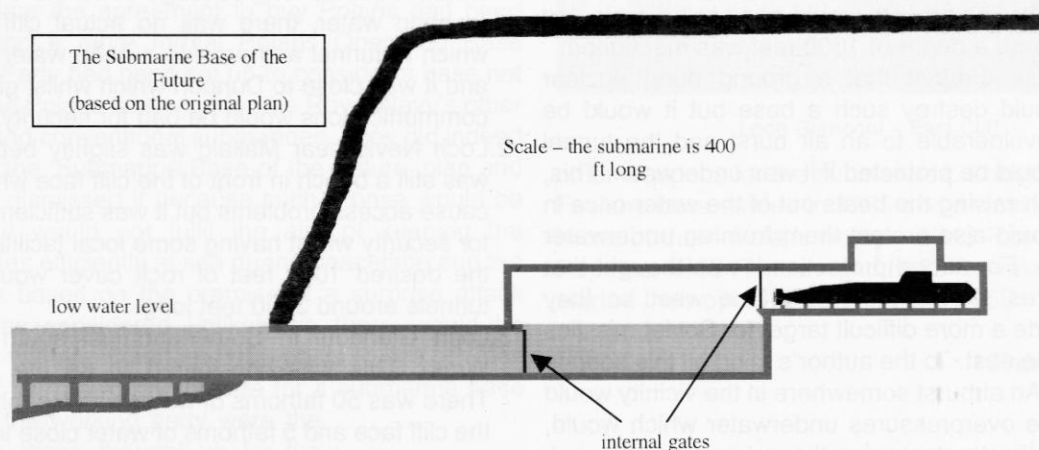


The Submarine Base of the Future

Readers who like the author look back on the days of real television with increasing nostalgia will remember the mid-1960s programme *Stingray* featuring the exploits of Captain Troy Tempest who together with his faithful sidekick 'Phones' and his fishy girlfriend Aqua Marina did daring deeds in their atomic-powered missile-firing submarine 'Stingray'. 'Stingray' was based in an underground dock under Marineville reached by a tunnel which lead directly from the sea. This underground dock was a complete fantasy but it might not have been had a plan drawn up by the Flag Officer, Submarines in 1961 been adopted by the Royal Navy. This plan entitled 'The Submarine Base of the Future' has just come to light at the National Archives and can be found in the file numbered Adm1/31048

By the early 1960s Britain's nuclear deterrent based on the V-bombers and Thor missiles was becoming obsolescent and thoughts were turning to possible replacements. After the Americans scrapped their Skybolt air-launched missiles which the RAF had been

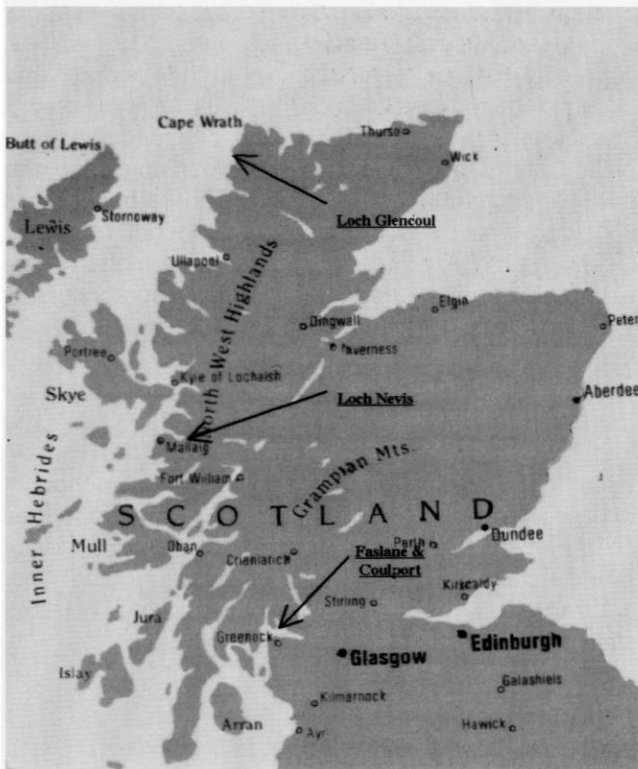
Submarines, the report said, need substantial support. They need docking, maintenance and repair facilities, supplies of fuel, weapons and other stores and accommodation and support facilities for their crews. Traditionally the Royal Navy had provided these by having shore bases around the globe together with specialised submarine depot ships. Shore bases were considered to be the cheaper option but obviously lacked the mobility of depot ships and were often in the wrong place when needed. But a new depot ship was expected to cost around £20 million. This was a huge sum at the time and for comparison was around 10 times more than the infrastructure costs budgeted for the Corsham central government war HQ (see http://www.subbrit.org.uk/rsg/features/sfs/new_page_5.htm for more details). Depot ships were also thought to be vulnerable in a nuclear war. This led to the idea of 'protected bases of the rock shelter type' which would house the submarines, ensure they would not get trapped in harbour at the beginning of a war and allow them to return to reload with missiles.



hoping to buy to give the V-bomber force a longer life Britain rapidly adopted the American Polaris submarine based missile system. A formal agreement to buy the missiles was signed in 1962 although some members of the defence community had apparently been thinking about the possibility of acquiring it for several years and had been quietly making plans. The Polaris missiles would need to be carried in a fleet of 4 or 5 submarines and they would need a home base. The Submarine Base of the Future would provide it.

The report argued that several countries such as Norway and Sweden had or planned underground bases and based on Swedish costs the planners estimated that 3 tunnels each taking one boat could be built, together with the necessary pumps, generators, etc, for some £4 million. As well as having the basic support facilities the underground bases would also need a dry dock, engineering, electrical and periscope workshops, armament stores including spare missiles, naval victualling and spare parts stores, reliable

The Submarine Base of the Future



communications, accommodation for staff, crews and repair parties (albeit austere) and air purification and filtering plant. The tunnels would need to be protected under rock and a depth of 1000 feet was mentioned.

The planners thought that a ground burst nuclear weapon would destroy such a base but it would be relatively invulnerable to an air burst and the tunnel entrance would be protected if it was underwater. This, together with raising the boats out of the water once in the dock would also protect them from an underwater shock wave. For added protection it was thought that the entrances should preferably face west so they would provide a more difficult target for Soviet missiles fired from the east. To the author's mind all this sounds very naïve. An airburst somewhere in the vicinity would surely cause overpressures underwater which would, even if not directly damaging the entrance cause rock falls which would block the entrance or its approach channels. The diagram drawn for the report whilst perhaps giving the base 1000 feet of rock cover does not include any exits to the surface which would be necessary but which would surely be vulnerable to being blocked by an air burst.

The submerged entrance would also serve to hide the base from air reconnaissance. Secrecy would also be assisted by vetting the construction workers and providing a cover story. The naivety of these suggestions can again be compared with the lengths that we gone to to provide cover stories for the more easily explained Corsham site.

Although the entrance would be underwater and the submarine would approach it submerged the boat

would not enter it under its own power. Instead, it would be positioned on the surface, then submerge onto a cradle or 'smooth slipway' to be drawn into the tunnel by winches. How the boat would then be raised up onto its out of the water shelf was not mentioned. Nevertheless, the report's writers continued with their ideas and drew up a list of criteria for the underground base –

- It should be in the UK for strategic reasons
- The rock cover should be at least 1000 feet of hard rock, preferably granite. Deep water access to the open sea was necessary.
- A navigable entrance deep enough for a submerged approach would be needed.
- The approaches should not subject to strong tides or currents.
- One tunnel should be provided for each boat 'greater than a megaton distance apart'.
- It should be distant from nuclear targets.
- Good communications and facilities to allow for peacetime use would be needed.

Having drawn up their criteria the writers made a paper study of possible sites on the west coast of Scotland and came up with 3 for further study –

1. Loch Striven in the Clyde approaches. This was quickly dismissed as 'virtually useless' because it would require a long passage down the Clyde to get to open water, there was no actual cliff face into which to tunnel and provide a deep water approach and it was close to Dunoon which whilst giving good communications would be bad for security.
2. Loch Nevis near Mallaig was slightly better. There was still a beach in front of the cliff face which would cause access problems but it was sufficiently remote for security whilst having some local facilities. To get the desired 1000 feet of rock cover would require tunnels around 2000 feet long.
3. Loch Glencoul in Sutherland just south of Cape Wrath. This was considered to be the best site. There was 50 fathoms of water within a mile or so of the cliff face and 5 fathoms of water close to it. To get the required protection the tunnels would have to be an average of 1700 feet long although the rock was not particularly suitable. The site was isolated which whilst good for security would be bad for communications.

There appear to be several inconsistencies between the favourite site and the 'wish list' of criteria. The site may well be isolated which would provide some security but it sounds like new roads would have to be built to it which would then only be used by people on naval business which would surely completely destroy any security. And the water depth is only 5 fathoms or 30 feet to us landlubbers but the submarine shown in the diagram is 60 feet high and the entrance tunnel is 80 feet high. In fact the diagram shows a depth of water at the cliff face of some 20 fathoms at low water.



The Submarine Base of the Future

In the best traditions of bureaucracy the report ended not by recommending that 'the submarine base of the future' should be built at Loch Glencoul but by recommending that a group should be set up to make further studies.

The file in the National Archives then shows the plan being considered by various people, none of whom, again in best bureaucratic traditions, committed themselves one way or another. The Director of Undersurface Warfare was in favour of a further study. The Director of Tactical and Weapons Policy thought it was interesting but further work should be deferred until the position on Polaris was known. The Director General of Naval Works thought that in reality the costs would be much higher than estimated in the report and possibly prohibitive. The Director of Plans suggested that the deterrent effect should depend not on the vulnerability or otherwise of bases but on the number of vehicles at sea or in the air. It was however not until the report reached the Deputy Chief of Naval Staff that it was killed off on the simple basis that to act as a deterrent the submarines should be at sea and not hidden in a base. Any further work would only delay other projects and he only took one action 'to stop further effort being devoted to this project' which was to thank Flag Officer, Submarines and to tell him that his plan would be taken into account.

By this time the agreement to buy Polaris had been signed and a more formal Polaris Operating Base Working Party had been set up to consider a base not just for the Polaris boats but for the Royal Navy's other nuclear and conventional submarines. They did indeed consider the 'Submarine Base of the Future' plan and promptly dismissed it because such a base would be remote, it would not fulfil the aim of keeping the submarines efficiently at sea during peacetime and the idea was based on the premise of a surprise attack which was considered unlikely so there would be sufficient warning time to get the boats to sea.

However, the basic parameters for a submarine base used by the working party were the same as those thought up by the designers of the submarine base of the future and this led them to shortlist 11 possible sites, 7 of which were in Scotland. All the sites on the south and east coasts from the Firth of Forth to Portland were however ruled out for lack of sufficient deep water and others were considered too remote or too close to populated areas for safety. Finally the Working Party recommended that Faslane should be developed as the Clyde Submarine Base with a supporting facility at nearby Coulport to store and handle the Polaris missiles and



Loch Glencoul – East Cliff

other weapons for the submarines. Construction of the Faslane base started in 1963 and it would become the home of the 4 Polaris boats – HMS Resolution, HMS Repulse, HMS Renown and HMS Revenge when they started their operational patrols in 1968.

From Steve Fox



HMS Renown

BRITISH AND GERMAN MILITARY TUNNELS AT HELIGOLAND, GERMANY



An illustrated article in the 19 February 1944 issue of Picture Post featured the underground military works at Heligoland, a rocky island about 30 miles off the North Sea German coast, and 42 miles northwest of Cuxhaven. Heligoland (German Helgoland, in Schleswig-Holstein) is about a mile long, and less than a third of a mile wide at its widest point, with a total area smaller than Hyde Park. There are precipitous cliffs on three sides, and an associated sand-bank called Dünsel-Insel. It is now something of a 'holiday island' and a fun day out for trippers from Cuxhaven. However, its strategic location has long been recognised, and it was a British possession from 1807 to 1890, when the UK ceded it to Germany in exchange for territory in Africa. The island can be used as a base for the defence of the entrances to the rivers Elbe and Weser, and to the Kiel Canal. The early British firm of contractors, Jolliffe & Banks of Merstham (east Surrey) carried out some work there in the first 30 years of the 19th century. Fortifications were installed by the British, and of the 8 miles of tunnels the lower series are British-built and lined with English bricks. After World War I it was amongst the conditions in the Treaty of Versailles that fortifications should be completely destroyed: but of course, it is not easy to destroy 8 miles of tunnels! The island was refortified at the direction of Adolf Hitler [1889 – 1945] with further (concrete-lined) tunnels and U-boat pens. There was also a power station in a concrete bunker. It was bombed by the RAF (presumably the tunnels were not much damaged other than their entrances) and the island was taken by the British in May 1945. Further British demolition work, by the Royal Navy, took place on 18 April 1947, and the RAF used it for bombing practice until 1952. The island was then returned to Germany!

The Picture Post article includes an aerial view, a view of the cliffs, some surface views, a one photograph taken inside a capacious concrete-lined tunnel showing rails lines and a junction, somewhat reminiscent of a Maginot Line fort.

The follows are extracts from the article:

Thirty miles from the German mainland, guarding the entrance to the Weser, Elbe and the Kiel Canal, stands Heligoland. It is smaller than Hyde Park, but to the Germans the red cliffs are symbolic. All their seaboard is flat. This is their one natural bastion....

The Germans boast they have made this tiny island off the mouth of the Elbe into the strongest bastion on the whole of the Invasion Coast ...

According to the German Overseas Agency, Rommel [Erwin Johannes Eugen ROMMEL [1891 – 1944]] has transformed Heligoland into "a defence bastion surpassing everything else in strength." He has sent all the civilians away and nobody is allowed on the island without a special pass. The defences, reinforced by concrete works of "unexampled" strength, are lauded as "gigantic."

There are underground food reserves, munition dumps and clothing stores, and the whole system is bound together with a railway system, which links the big-gun emplacements too. The Germans are going to great lengths to publicise these defence works; apparently they feel that they have talked rather too long about the "impregnability" of the Western wall, and that the public may be getting tired of the subject. So their publicity organisation has been ordered to concentrate its monstrous mind on this tiny island, no bigger than Hyde Park, 30 miles off the mouths of the rivers Elbe and Weser and commanding the approaches to the Kiel Canal, Hamburg and Bremen.

The Germans have a peculiar obsession about Heligoland because it hasn't been in their possession long and, of course, this leads them to suspect that it may not be in their possession much longer. As every schoolboy ought to know, Britain seized Heligoland, after Nelson's "blind-eye" engagement, in 1807, and gave it up in 1890 in return for the remote island of Zanzibar. ...

Heligoland would certainly have been useful to us in 1914. The Versailles Peace Conference showed its appreciation of Heligoland's usefulness to a war-mongering Germany by ordering the destruction of the fortifications ...

SOURCE: ANON, 1944, Heligoland – Rommel's invasion bastion. Picture Post 22(8), 7 – 9.

From Paul Sowan



An Edwardian underground shopping arcade discovered in Keithley, West Yorkshire

Until the mid 1860s, the site of the Royal Arcade had been Devonshire Estate land in common with virtually the whole of central Keighley. William Senior's map of 1612 shows the land extending north as a series of parallel strips from the eastern end of what was to become Low Street. Each strip contained a substantial house with gardens fronting onto Low Street with more extensive gardens to the rear.

By the 19th century the town had expanded with the coming of local industries and commerce and the houses in Low Street had all been demolished or converted. The earliest map showing the future site of the Royal Arcade in reliable details was published between 1825 - 1838. This shows that one property had been selected and a conversion had taken place with the house forming a core building, added to and extended by various wings and attachments. The 1847 Ordnance Survey map shows the house as part of a continuous line of buildings although it retained gardens at the front and rear.

The land remained part of the Devonshire Estate until the middle of the 19th century when financial instability forced some land disposal by the Duke's agents. The Low Street site seems to have been amongst the earliest to be affected and had been disposed of by 1860.

By the end of the 19th century the site was in the ownership of Turner & Fowlds who already owned a yard and showrooms on the opposite side of Low Street.

In March 1899, five months before the last phase of the land purchase was finalised, Turner & Fowlds applied to the local authority for permission to build a covered shopping arcade. While the older buildings on the site would be retained the other buildings would be demolished to make way for the new arcade.

The fundamental element of the plan was to provide the maximum amount of shops with shop windows fronting onto publicly accessible roads or walkways. The proposed covered arcade formed a 'T' plan with its entrance on Low Street. The east - west axis of the Turner & Fowlds site ran from Fleece Street to



Shops can be seen on both side of the underground walkway -
Photo by Nick Catford

intercept the cross bar of the arcade. To avoid confusion the north - south section of the arcade will now be referred to as the Low Street Arcade and the east - west section as the Fleece Street Arcade.

Within the roughly rectangular plot of land it was proposed to build 12 shops back to back with 6 units having windows onto Low Street and six with windows onto the Fleece Street Arcade. On both ends of this block there were further units fronting onto Fleece Street and the Low Street Arcade. On the west side of the Low Street Arcade there were to be a further five shops fronting onto the arcade. Two further shops were added at the north end of Fleece Street,

The most distinctive feature of the Royal Arcade was located at the north end of the Low Street arcade where the covered walkway terminated in a single large covered area that occupied the yard space of the earlier buildings with a suspended gallery projecting from the north, east and west walls.

The arcade was to be built within a plot of land bounded by Low Street, the proposed Low Street arcade, Fleece Street and the proposed Fleece Street arcade.

As the full depth of the shops at ground level was given over to retail sales, merchandise storage had to be provided elsewhere. For the largest shops, the solution was to provide cellar space accessed by individual flights of steps from the shops above. Below the

An Edwardian underground shopping arcade discovered in Keithley, West Yorkshire

smaller shops the space was undivided and accessible only from a door and steps in the Low Street arcade. It is probable that this portion of the cellar was communal and may also have been available to the south range of shops in the Fleece Street arcade which appear to have been single room lock ups only. Further access to the storage cellar units was by corridors that lay below the arcade walkways

The application was approved with some minor amendments and the complex of shops, arcade and living accommodation above was completed by 1901 and formerly known as the Royal Arcade and Crown Buildings.

Nothing has emerged in documentation to show how successful the Royal Arcade was in returning Turner and Fowlds' investment but it didn't stay in joint ownership for long. Turner died in 1915; at that time the Royal Arcade was owned jointly with Hiram Faulds but by 1919 it was in the sole ownership of Turner's sons Ernest and Wilfrid. As soon as they had taken control of the site, the Turner brothers began a piecemeal disposal of the property. By 1933 a large proportion of the arcade was owned by Frank Butterfield. Butterfield had been a partner in Gott & Butterfield's iron mongers who had been tenants at the arcade since at least 1919. Their shop was once described as an 'Aladdin's cave' selling household goods, bicycles and camping equipment and the whole arcade was popularly known as 'Butterfields Arcade'. Frank Butterfield Ltd. continued to run the arcade but by the 1980s the business was in decline and the arcade was in a very poor condition and it finally closed in 1987. Although some of the flats above the shops remained in occupation for some years after that, the arcade was largely derelict for 12 years until it was acquired by Kingfisher Developments in 1999. They proposed renovating the Grade II listed building to its former Edwardian splendour.

During the early stages of this renovation a clearance programme was undertaken including the cellars which by that time were almost completely full of rubbish. It was at that time that the true nature of the cellars was discovered for the first time. Once the cellars had been partially cleared it became apparent that there was a complete lower level arcade of shops below ground along both sides of an underground 'street'. Some of the shops still have their glass windows intact, together with front doors, letterboxes and door numbers.

A number of enamel advertising signs were also found indicating that the shops were probably used from an early date, perhaps even from the opening of the Royal Arcade and Crown Buildings in 1901.

The accessible shops and cellars run around three sides of the plot of land bounded by Low Street, Fleece Street and the Royal Arcade. The original pedestrian entrances to the arcade was down stone steps in

Hanover Street and to the rear of Fleece Street but these stairs have now been sealed and the only access to the underground area is down a flight of wooden steps at the rear of the Royal Arcade and a flight of stone steps from an open yard in the middle of the site, this was originally the end of a short cart track used for deliveries to the shops.

Originally most of the cellars had wooden stairs up to the shops above; most of these have now gone although there is still access from one or two of the shops. The arcade was lit by 'pavement lights' set into the pedestrian walkways and streets but these have all now been covered over and the cellars are in darkness.

Once the restoration of the arcade had been completed it was officially reopened as by Keighley historian Ian Dewhirst on 27th June 2003. The arcade consists of nine shops on the ground floor and 23 flats on upper floors and it quickly had 100 per cent occupancy.

There are no immediate plans to open the lower level of Edwardian shops to the public on a regular basis although part of the site has been made safe with occasional public open days. Seven of the shops can be viewed and this area now has low level lighting. A further five shops have yet to be cleared and as yet there is no public access to this area.

The main entrance for the public tours is down the wooden steps at the rear of the Royal Arcade. This opens onto the communal cellar area described above. At the end of this area there is a steel door leading through to the arcade. Adjacent to the door there is a bread oven set into the wall. Once through the door there is one shop on the right hand side then the walkway turns to the left through 90 degrees with a further three shops on the left and three on the right. Beyond this there is a wooden door leading to steps up to the yard and a further five shops that have not yet been cleared.

A large enamel sign has been used to block one of the windows, it says 'Use Hart batteries for motor car electric lighting and starting'. There is also a large advertising hoarding for 'Butterfield Iron Mongers and Tool Specialists' and a glass panelled door with the wording 'Bacon and goods' painted on the glass.

Sources:

'Structural Perspective' - An archaeological report on the site

Frank Brook - Kingfisher Developments

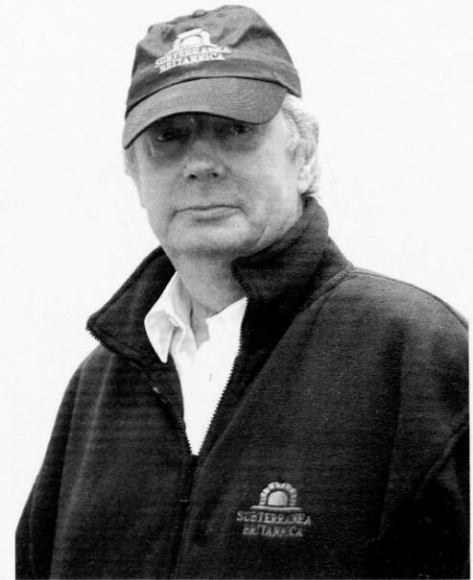
From Nick Catford



SUBTERRANEA SHOP - PRICE LIST AND ORDER FORM



SUBTERRANEA BRITANNICA



All items are in Navy Blue with the Subterranea Britannica logo and name in light blue.

Item	Size	Price	Qty
'Fruit of the Loom' Sweatshirt	S-36" M-38" L-40 to 42" XL-44 to 46" XXL-48"	£20.95
Cotton polo shirt	S-36" M-38" L-40 to 42" XL-44 to 46" XXL-48"	£18.95
Lambs wool V neck sweater	S-36/38" M-40/42" L-44" XL-46/48"	£39.95
Baseball cap, unlined	One size fits all	£8.95
Boiler suit	S M L XL	£31.95
Full zip fleece	S M L XL XXL	£28.95
Total purchases	Value	£	

Name:..... Please debit my credit card: Visa/MasterCard

Address:..... Number:.....

..... Expiry date:.....

..... Post code:..... Signature:.....

Telephone number:..... **Postage and packing will be added at cost.**

If you prefer to pay by Cheque, please telephone first to obtain postage and packaging cost. Other items are available on request, please telephone for a quotation

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